SECTION A (40 marks)

Answer **all** *questions.*

Question 1.

(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 are more than one choice circled, NO score will be awarded.*** **[15]**

(i) All of the following are examples of colligative properties ***EXCEPT***

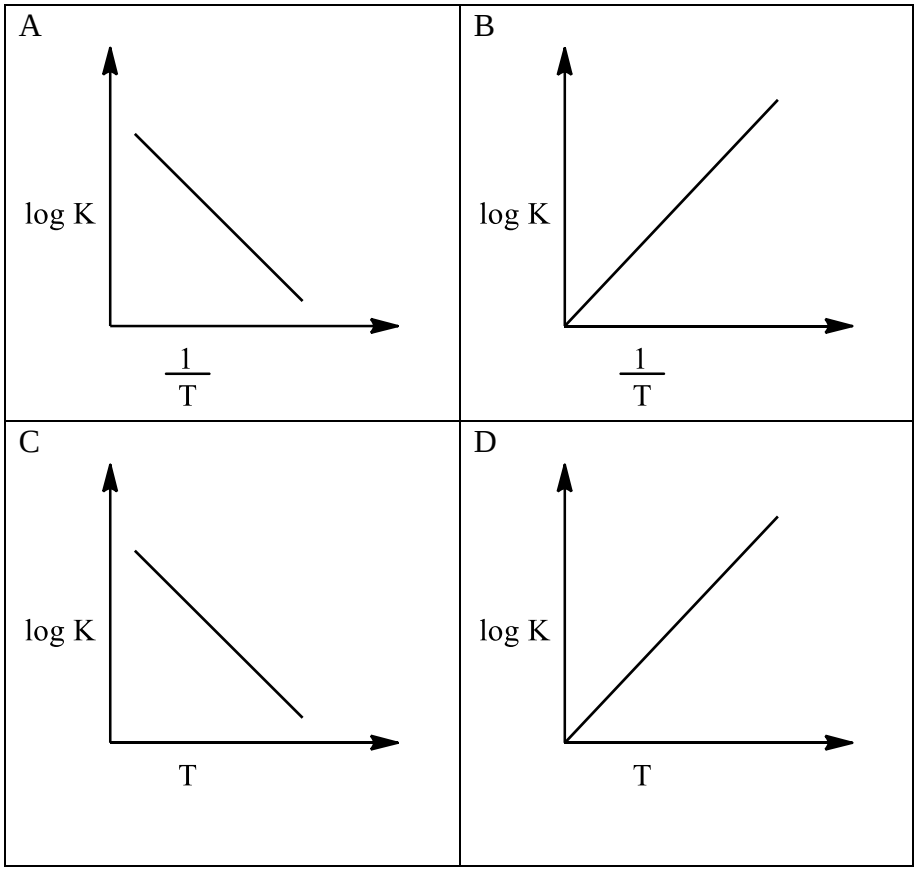
A freezing point.

B osmotic pressure.

C elevation of boiling point.

D relative lowering of vapour pressure.

(ii) Arrhenius equation is used to calculate activation energy of a reaction. Which of the following graphs is used to calculate activation energy of a reaction?



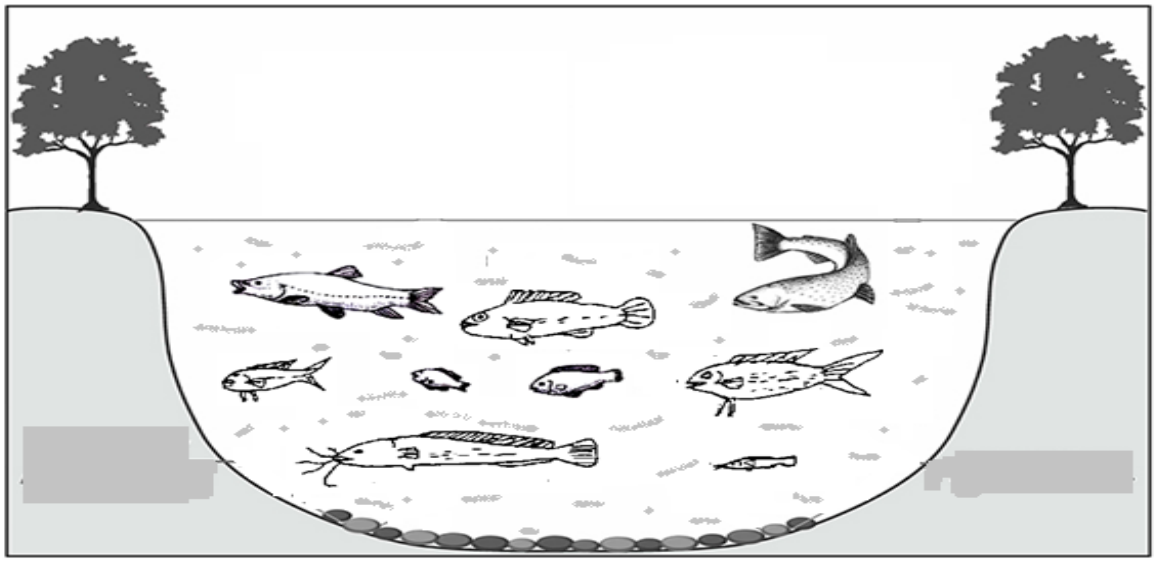
(iii) pH of water is 7. When a substance 'Y' is dissolved in water, the pH becomes 13. 'Y' is a salt of a

A weak acid and a weak base.
B strong acid and a weak base.
C weak acid and a strong base.
D strong acid and a strong base.

(iv) The standard reduction electrode potential of three metals X, Y and Z Are -2.38 V, -1.05 V and + 0.34 V respectively. The increasing order of their reducing power is

A Z < Y < X.
B Y < Z < X.
C X < Y < X.
D Z < X < Y.

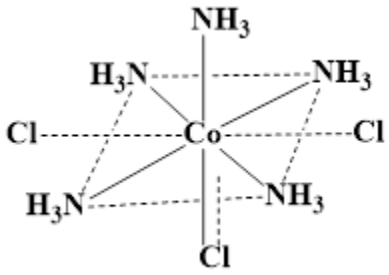
(v) The diagram given below represents a thermodynamic system.



The system is

A an open system.
B an ideal system.
C a closed system.
D an isolated system.

(vi) The secondary valency of the coordination compound given below is



A 3.
B 5.
C 6.
D 8.

(vii) $C_6H_5CH_3 \xrightarrow{CrO_2Cl_2} X + H_2O$

The compound *X* formed in the above reaction reduces Tollen's Reagent to form silver mirror. Its reducing property is due to the presence of

A H-atom attached to carbonyl carbon atom.
B presence of α-H-atom.
C H-atom of phenyl group.
D absence of α-H-atom.

(viii) Which of the following shows the increasing order of acidic strength?

A $HCOOH < CH_3COOH < C_6H_5COOH$
B $CH_3COOH < HCOOH < C_6H_5COOH$
C $C_6H_5COOH < CH_3COOH < HCOOH$
D $CH_3COOH < C_6H_5COOH < HCOOH$

(ix) Acetamide can be converted to methyl amine by

A Etard reaction.
B Rosenmund reaction.
C Cannizaro's reaction.
D Hoffman bromamide reaction.

(x) Fats and oils are

A diesters of glycerol and fatty acids.
B triesters of glycerol and fatty acids.
C diesters of glycol and fatty acids.
D triesters of glycol and fatty acids.

(xi) The correct order of the main parts of a spectrometer to obtain mass spectrum is

A 

B 

C 

D 

(xii) A decrease in entropy is expected during
- A melting of ice.
- B rusting of iron.
- C vaporization of iodine.
- D crystallization of sucrose from solution.

(xiii) Aliphatic amines and aromatic amines can be distinguished by
- A Azo dye test.
- B Biuret test.
- C Carbylamines test.
- D Hinsberg's test

(xiv) Which of the following is the freezing point depression of 2 m (molal) glucose solution (K_f for water is 1.86 K kg mol^{-1})?
- A 1.86 K
- B 2 K
- C 3.72 K
- D 7.44 K

(xv) Which compound exhibits the following properties:
molecular mass m/e = 58, IR absorption frequency at 1725 cm^{-1}
and singlet in its NMR spectrum?

A CH_3-CH_2-CH_2-CH_3

B CH_3-C(=O)-CH_3

C CH_3-CH_2-CHO

D CH_3-CH(CH_3)-CH_3

(b) Fill in the blanks with appropriate word/s. **[5]**

(i) In a nickel cadium storage battery, the cathode consists of a metal grid containing …….. immersed in KOH solution.

(ii) The rate of zero order reaction…….. with time.

(iii) Propyl bromide gives …….. signals in NMR spectrum.

(iv) Acetyl chloride's high reactivity is due to …….. effect of chlorine.

(v) All naturally occurring amino acids are optically active except ……

(vi) An aqueous solution of a mixture of NH_4OH and NH_4Cl forms a …….. solution with a pH …….. than 7.

(vii) The osmotic pressure of 1 M $AlCl_3$ will be …….. than 2 M glucose.

(viii) Terylene is obtained by the combination of ethylene glycol and ……..

(ix) The coordination compound which is used as an anti-tumor agent in treatment of cancer is ……

(c) Match each item of Column A with the most appropriate item of Column B. Rewrite the correct pairs by writing the number and the corresponding alphabet in the spaces provided. **[5]**

Column A	**Column B**
(i) Functional group region	a. P^{30}
(ii) Lead storage	b. Sec^{-1}
(iii) Treatment of skin diseases	c. primary cell
(iv) Ionic product of water at 25˚C	d. IR spectrum
(v) First order reaction	e. NMR spectrum
(vi) Dry cell	f. HCO_3^-
(vii) Ethylene diamine	g. secondary cell
(viii) Treatment of cancer growth	h. 10^{-7}
(ix) Chemical shift	i. Co^{60}
(x) Conjugate acid of CO_3^{2-}	j. bidentate ligand
	k. 10^{-14}
	l. $moll^{-1}\ sec^{-1}$
	m. monodentate ligand

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(d) Correct the following statements by changing only the underlined words. Rewrite ONLY the correct answer. DO NOT copy the whole sentence. **[5]**

(i) Mass spectroscopy is the analytical technique used to identify steroids in blood and urine.

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(ii) Acetone reacts with hydrogen cyanide to form acetone cyanohydrin. This reaction is an example of electrophilic substitution.

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(iii) Ester bonds link the protein polymers of amino acids.

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(iv) Acetic acid and propanoic acid are the products formed on oxidation of acetone with concentrated nitric acid.

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(v) In an isobaric process, no heat enters or leaves the system during any steps of the reactions taking place.

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(e) Answer the following questions.

(i) There are many different types of batteries. From amongst the following: dry cell, mercury cell, lead storage cell and Nicad cell, which battery will be suitable to use in cell phones and calculators? Give a reason to support your answer. **[1]**

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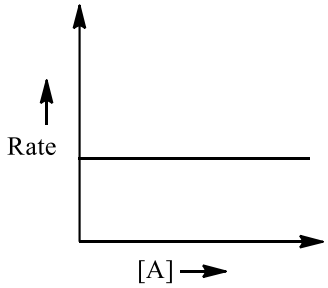
(ii) The graph for the rate of a reaction against molar concentration of reactant 'A' for a reaction A $\longrightarrow$ B, is shown below:



1. What is the order of the reaction? **[½]**

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2. Write the relationship between rate constant 'K' and half-life period (t ½) for the above reaction. **[½]**

(iii) 'The evaporation of water is a spontaneous endothermic reaction'. Explain why. **[1]**

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(iv) Write ***one*** difference between natural and artificial radioactivity in the table given below: **[1]**

Natural radioactivity	**Artificial radioactivity**

(v) Most of the coordination complexes are coloured. State ***two*** factors on which colour of the complexes depend. **[1]**

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(vi) Write the balanced chemical equation for the preparation of oxalic acid from sucrose. **[1]**

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(vii) Aniline is a weak base. Explain. **[1]**

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(viii) Which is biodegradable, nylon 66 or teflon polymers? Why? **[1]**

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(ix) Write ***two*** differences between saturated and unsaturated fats in the table given below. **[1]**

Saturated fats	**Unsaturated fats**

(x) Study the conversion reaction given below:

$$CH_3COOH \xrightarrow{I} CH_3COCl \xrightarrow{II} CH_3CONH_2$$

Identify reagents I and II. **[1]**

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SECTION B (60 marks)

Answer any **six** *questions.*

Question 2.

(a) The mole fraction of an aqueous solution of a non-volatile solute is 0.01. Its vapour pressure is 34.65 torr. What is the vapour pressure of pure water at the same temperature? **[2]**

(b) The diagrams given below represent two spectra.

Figure I

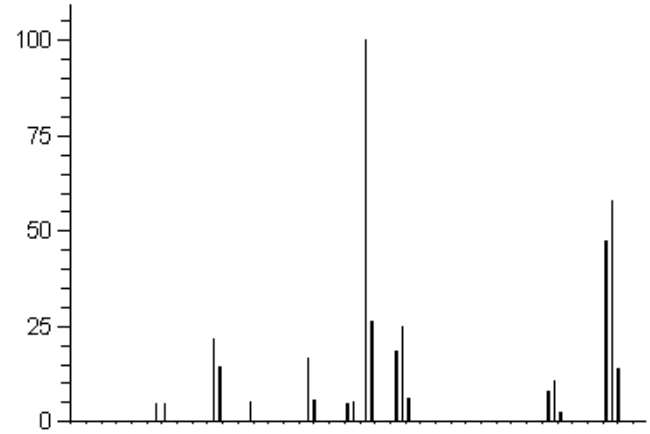
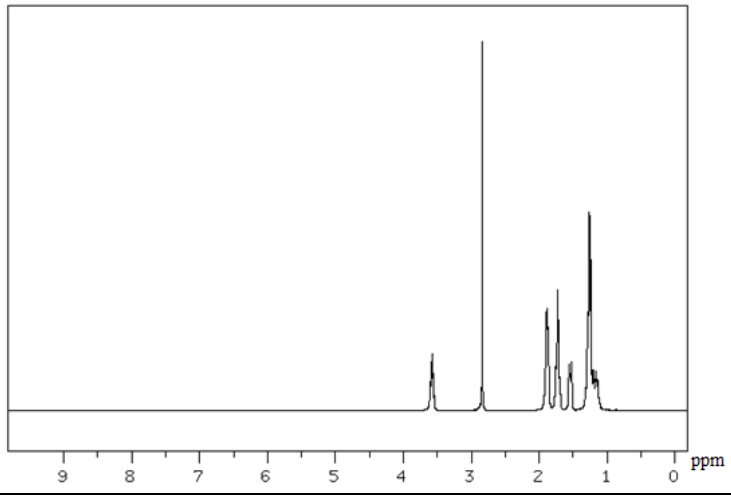


Figure II



(i) Which of the figures given above shows mass spectrum? Support your answer. **[1]**

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(ii) Explain the basic principles of mass spectrometry. **[1]**

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(c) The enthalpy change (ΔH) for a reaction $N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$ is -98 kJ at 300 K. What is ΔE at 300 K? **[3]**

(d) (i) With the help of an example, explain Cannizzaro's reaction. **[2]**

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(ii) An element 'A' undergoes a series of nuclear transformation to form an element 'D' as shown below: **[1]**

$$A \xrightarrow{-\alpha} B \xrightarrow{-\beta} C \xrightarrow{-\beta} D$$

1. What is the similarity between 'A' and 'D'?

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2. What are such elements called?

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Question 3.

(a) (i) State (n+1) rule of splitting pattern of protons. **[1]**

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(ii) Study the compound, $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_3$.

1. How many signals do you observe in NMR spectrum? **[½]**

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2. Predict the splitting pattern of $-CH_2-$ group by (n+1) rule. **[½]**

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(b) While carrying out titration of NaOH with CH_3COOH, which indicator is preferred, methyl orange or phenolphthalein? Justify your answer with a relevant pH curve. **[2]**

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(c) (i) The table given below shows the standard reduction potential of different elements.

Elements	A	B	C	Cu
Reduction potential	-0.74 V	-1.67 V	+0.80 V	+0.34 V

Which element can be used to stir 1 M Cu $(NO_3)_2$ solution? Why? **[1½]**

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(ii) $A^{2+} + B \longrightarrow A + B^{2+}$

Will this reaction occur? Support your answer. **[1½]**

(d) Consider the reaction, $A + B \longrightarrow C + D$. The initial rates for the different concentrations of the reactants are given below:

Experiment No.	Initial concentration (mol L^{-1})		Rate (mol L^{-1})
	A	B	
1	0.38	0.38	5×10^{-3}
2	0.76	0.76	4×10^{-2}
3	0.38	0.76	1×10^{-2}

(i) Write the rate law. **[1½]**

(ii) Calculate the rate constant. **[1½]**

Question 4.

(a) Find the coordination number for the following complexes and give reasons to support your answer.

(i) Co in $[Co\ (en)_3]^{3+}$ **[1]**

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(ii) Fe in $[Fe\ (edta)]^-$ **[1]**

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(b) Write a balance chemical equation for the alkaline hydrolysis of terylene. **[1]**

(c) (i) The solubility of aliphatic carboxylic acids decreases with increase in their molecular mass. Explain. **[2]**

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(ii) What is the IUPAC name of acetic acid? **[1]**

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(d) Explain the following statements:

(i) Some fishes like Salmons cannot survive if the temperature is above 15˚C. Why? **[1]**

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(ii) At high altitudes, it is risky to drive due to snow fall. To make the roads safe for driving, salt is sprinkled. Why? **[1]**

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(e) Explain the separation technique of HPLC. **[2]**

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Question 5.

(a) What is conjugate acid-base pair? Explain with an example. **[2]**

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(b) $H_2O_{(l)} + 40.8\ kJ \longrightarrow H_2O_{(g)}$ is energetically unfavourable, yet the reaction is spontaneous. Explain. **[2]**

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(c) An organic compound 'A' with a molecular formula C_2H_4O undergoes oxidation to form compound 'B'. This compound on reaction with ammonia forms compound 'C', which is an amide compound. **[2]**

(i) Identify compounds 'A', 'B' and 'C'.

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(ii) What will happen when $NaHCO_3$ is added to compound 'B'?

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(d) During a scout camp, students were taken for rock climbing. They were given nylon and cotton fibres to make their own ropes. Which fibre will be better for rock climbing? Why? **[2]**

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(e) (i) State the ***two*** regions of a IR spectrum. **[1]**

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(ii) What is the significance of these regions? **[1]**

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Question 6.

(a) Explain the following statements:

(i) Zn^{2+} compounds are colourless. **[1]**

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(ii) Vanadium pentaoxide acts as a catalyst. **[1]**

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(b) Calculate the enthalpy for the reaction: $H_2 + F_2 \longrightarrow 2HF$.
Given the bond enthalpies of H_2, F_2 and HF are 434 kJ mol^{-1}, 158 kJ mol^{-1}
And 565 kJ mol^{-1} respectively. **[2]**

(c) For both first and second order reactions, the rate increases with increase in concentration, yet both have different units of rate constant. Why? **[2]**

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(d) (i) Define denaturation of protein. **[1]**

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(ii) What is the effect of denaturation on the structure of proteins? **[1]**

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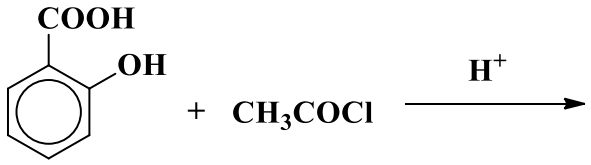
(e) Complete and name the products formed in the following reactions: **[2]**

(i)



(ii) $2CH_3COOH \xrightarrow{P_2O_5\ \triangle}$

Question 7.

(a) (i) What is observed when acetic acid is heated with ethyl alcohol in the presence of conc. H_2SO_4. Support your answer with a balanced chemical equation. **[2]**

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(ii) Write ***two*** uses of formaldehyde. **[1]**

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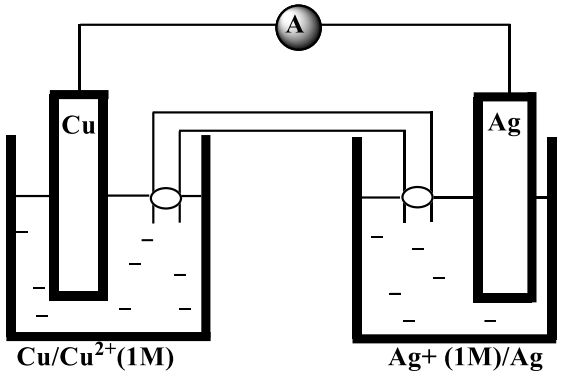
(b) The diagram give below shows two electrochemical cells.

Cell I

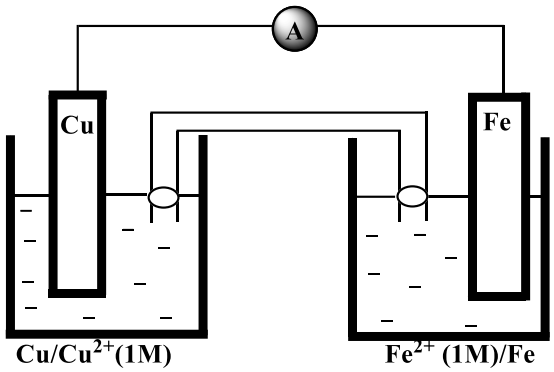


Given:

$Cu^{2+}/Cu = 0.34$ V

$Ag^{+}/Ag = 0.80$ V

Cell II



Given:

$Cu^{2+}/Cu = 0.24$ V

$Fe^{2+}/Fe = -0.44$ V

(i) Which of the electrochemical cell is functional and why? **[1]**

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(ii) Calculate the emf of the functional cell given in (i) if the concentration of ions undergoing oxidation is 0.13 M and reduction is 0.01 M respectively. **[2]**

(c) Amino acids behave as zwitter ions in neutral solutions. Towards which electrode will amino acids migrate in an acidic solution? Why? **[1]**

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(d) Write the mechanism for the reaction of acetyl chloride with ethyl alcohol. **[2]**

(e) Write a balanced chemical equation for the preparation of ethyl amine from ethane nitrile. **[1]**

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Question 8.

(a) The diagram given below represents two different solutions of the same concentration. **[2]**

0.5 KCl	0.5 urea

(i) Which of the two solutions will have a higher osmotic pressure at the same temperature? Why?

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(ii) From which solution will the solvent flow?

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(b) (i) Neutrons are better initiators of nuclear reactions than protons or alpha particles of the same energy. Why? **[1]**

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(ii) Define molecularity of a reaction. **[1]**

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(c) Give ***one*** chemical test to distinguish between aniline and ethylamine. **[1]**

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(d) How will you convert: **[2]**

(i) nitrobenzene to aniline?

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(iii) isopropyl alcohol to acetone?

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(e) (i) Calculate $[H^+]$ and $[OH^-]$ for a soft drink which has pH 4.80. **[2]**

(ii) Aldehydes and ketones have similar chemical properties. Why? **[1]**

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for ROUGH WORK

for ROUGH WORK