Question 1 **[8]**

Substances **C-1** and **C-2** are organic compounds. Carry out the following experiments and record the smell of gas evolved, color of the solution obtained and precipitate formed in the given table. Based on your observations and deductions, identify the functional group present in the compound.

(a) Substance C-1

Qn. No.	Procedure	Observation	Deduction
(i)	Take 1 mL **C-1** in a clean test tube and add equal volume of a saturated solution of sodium bisulphite. Shake the content and allow it to stand for a few minutes.		
(ii)	Take 2 mL 2, 4-dinitrophenylhydrazine solution in a test tube and add 1 mL **C-1** and warm it.		
(iii)	Take 1 mL **C-1** in a test tube and add 2 mL Tollen's reagent to it. Warm the content in a water bath for about 5 minutes.		
(iv)	Take about 2 mL Fehling's solution and add a few drops of **C-1**. Warm in a water bath for about 5 minutes.		

(b) Substance C-2

Qn. No.	Procedure	Observation	Deduction
(i)	Take 1 mL **C-2** in a test tube and add a few drops of blue litmus solution.		
(ii)	Take 1 mL of **C-2** and add a pinch of sodium bicarbonate.		
(iii)	To 1 mL **C-2**, add 2 mL ethanol and add a few drops of conc. H_2SO_4. Heat the content in a boiling water bath. Then pour the content in a beaker containing cold water.		
(iv)	Shake 1 mL **C-2** with 3 mL distilled water in a clean test tube and add ammonium hydroxide drop wise till a clear solution is obtained. Then add a few drops of neutral $FeCl_3$ solution.		

Question 2 **[5]**

You are provided with the following two solutions:

(i) 0.01 M copper sulphate solution.

(ii) The unknown concentration of zinc sulphate solution.

The standard reduction potential of copper and zinc are 0.34 V and – 0.76 V respectively.

Set up the electrochemical cell by taking 40.0 mL each of these solutions. Measure the emf value of the cell using voltmeter and record it below. *Show the emf reading to the* ***Visiting Examiner.***

(a) Based on the above experiment, answer the following questions:

(i) Write the emf value obtained.

(ii) Write a balanced cell reaction.

(iii) Give the cell representation of the galvanic cell.

(iv) Determine the unknown concentration of zinc sulphate solution using Nernst equation.

Question 3 **[7]**

Analyze qualitatively the substance **C-3** which contains two cations. Identify these cations.

Show one confirmatory observation of a cation to the ***Visiting Examiner*****.**

While testing for cations you must mention:

(i) How the original solution for group analysis was prepared

(ii) The formal group with pertinent group reagents

(iii) One confirmatory test for each cation

Note:

1. Use of qualitative analysis booklets/tables are not allowed.
2. Tabulate the experiment, observation and inference as per the format given below.
3. If the *experiment* is incorrect, no marks will be awarded for the *observation* and *inference*.

Sl.No	Experiment	Observation	Inference

Question 1 **[7]**

Using the following materials provided, carry out the experiment as outlined under the procedure.

Materials required

(i) Leaf extract

(ii) Capillary tube

(iii) Chromatography jar

(iv) Chromatography paper

(v) Acetone and diethyl ether

Procedure

(i) Take a chromatography paper appropriately sized according to the jar.

(ii) Draw a line with a sharp pencil about 2 cm above the lower end of the chromatography paper and mark the spot on the centre of the line.

(iii) Load the leaf extract on the spot using a fine capillary tube and let it dry in air.

(iv) Take adequate amount of a solution of ether and acetone in the ratio of 8:2 in the chromatography jar and suspend the loaded paper in the jar such that the load is above the solvent level.

(v) Close the jar with its lid and keep it undisturbed.

(vi) Remove the chromatography paper when the solvent is about 2 cm below the upper end of the chromatography paper.

(vii) Mark and measure the distance travelled by the solvent and pigments from the reference line.

(viii) Show your dried chromatogram to the ***Visiting Examiner*** and attach it to the answer booklet. Record your observations in the table given below.

Observation Table:

Leaf pigment	Colour	Distance travelled by solvent (cm)	Distance travelled by pigments (cm)	R_f value
Chlorophyll a				
Chlorophyll b				

(a) Answer the following questions:

(i) Identify the mobile and stationary phase.

(ii) State the principle of paper chromatography.

(iii) Write the mathematical expression for the calculation of R_f.

(iv) Write **two** applications of paper chromatography.

Question 2 **[5]**

You are provided with the following two solutions:

(i) 0.01 M copper sulphate solution.

(ii) The unknown concentration of zinc sulphate solution.

The standard reduction potential of copper and zinc are 0.34 V and – 0.76 V respectively. Set up the electrochemical cell by taking 40.0 mL each of these solutions. Measure the emf value of the cell using voltmeter and record it below. *Show the emf reading to the* ***Visiting Examiner.***

(a) Based on the above experiment answer the following questions.

(i) Write the emf value obtained.

(ii) Write the cell reaction.

(iii) Give the cell representation of the galvanic cell.

(iv) Determine the unknown concentration of zinc sulphate solution using Nernst equation.

Question 3 **[8]**

Analyze qualitatively the substance **C-4** which contain two cations. Identify these cations.

Show one confirmatory observation of a cation to the ***Visiting Examiner.***

While testing for cations you must mention:

(i) How the original solution for group analysis was prepared

(ii) The formal group with pertinent group reagents

(iii) One confirmatory test for each cation

Note:

1. Use of qualitative analysis booklets/tables are not allowed.
2. Tabulate the experiment, observation and inference as per the format given below.
3. If the *experiment* is incorrect, no marks will be awarded for the *observation* and *inference*.

Sl.No	Experiment	Observation	Inference

For Rough Work

Question 1 **[5]**

Substances **C-5** and **C-6** are organic compounds. Carry out the following experiments and record the smell of gas evolved, colour of the solution obtained and precipitate formed in the given table. Based on your observations and deductions, identify the functional group present in the compounds.

(a) Substance C-5

Qn. No.	Procedure	Observation	Deduction
(i)	Take equal volumes of **C-5** and a saturated solution of $NaHSO_3$ in a clean test tube. Shake and allow it to stand for a few minutes.		
(ii)	Take 2 mL of 2, 4-dinitrophenyl hydrazine solution in a clean test tube and add 1 mL **C-5** and warm it. Allow it to stand for a few minutes.		
(iii)	Take 1 mL of **C-5** in a test tube and add 2 mL of Tollen's reagent to it. Warm the content in a water bath for about 5 minutes.		

(iv)	Take 1 mL of **C-5** in a test tube and add 1mL of sodium nitroprusside solution. Then add a little NaOH solution dropwise.		

Substance C-6

Qn. No.	Procedure	Observation	Deduction
(i)	Take 1 mL **C-6** in a clean test tube and add a few drops of CH_3COOH and 2-3 drops of conc. H_2SO_4. Then warm the content in a water bath for 5 minutes.		
(ii)	Take 1 mL of **C-6** in a test tube and add 1 gm (1-2 pellets) of KOH and warm till the pellets dissolve. Cool and add 5 drops of carbon disulphide (CS_2) solution and shake.		
(iii)	Take 1mL of **C-6** in a test tube and add 1 mL of ceric ammonium nitrate solution.		

(iv)	Take 1 mL of **C-6** in a clean and dry test tube and add a piece of anhydrous $CaCl_2$. Then add a small piece of freshly cut sodium metal.		

Question 2

You are provided with solutions of following concentrations: **[10]**

(a) Copper sulphate solution: 10^{-1} M $CuSO_4$ (**A**), 10^{-3} M $CuSO_4$ (**B**), 10^{-5} M $CuSO_4$ (**C**), 10^{-6} M $CuSO_4$ **(D)** and unknown concentration $CuSO_4$ (**E**).

(b) 0.1 M Zinc sulphate solution.

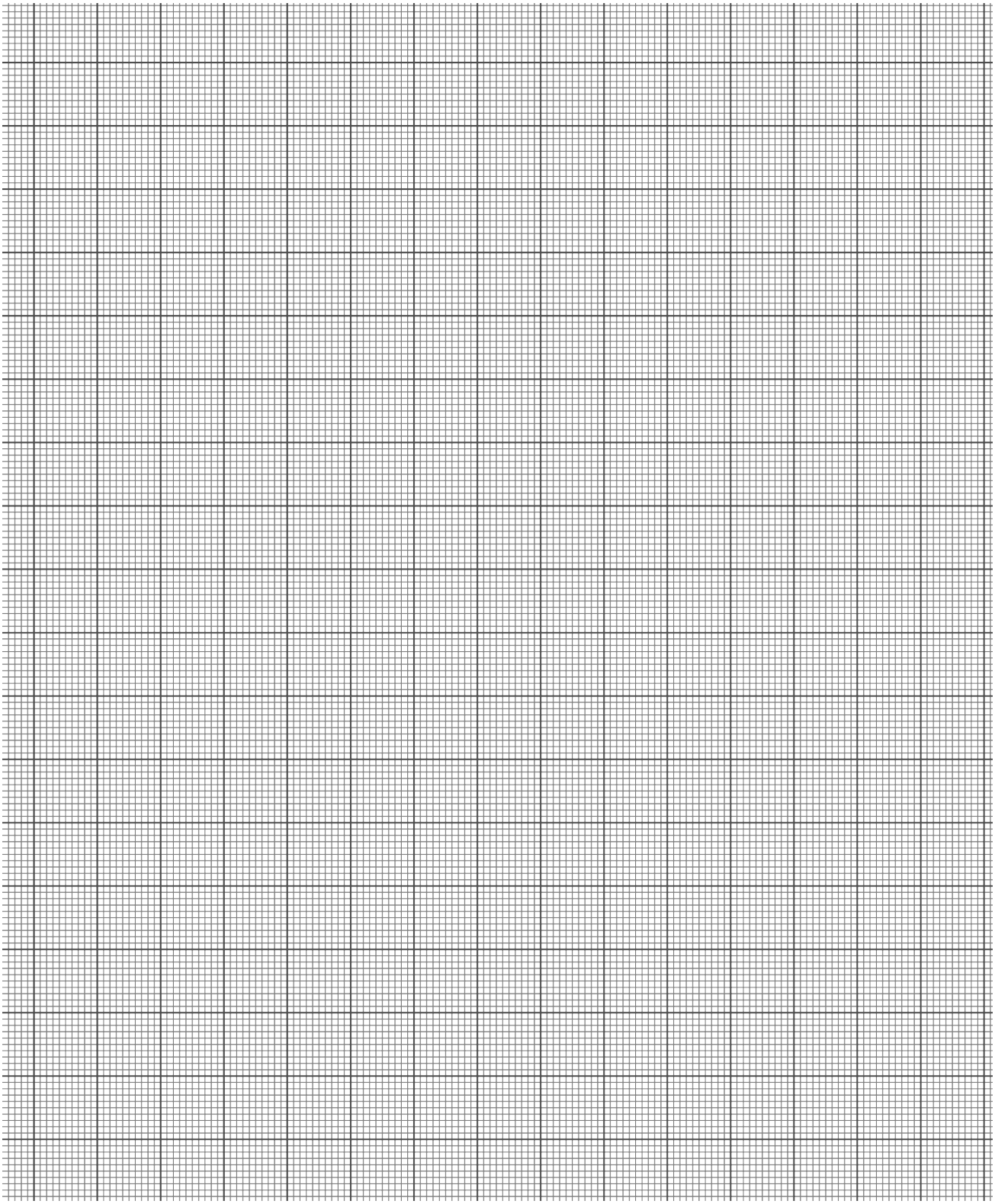
Set up a galvanic cell using 40 mL each of the given copper sulphate solutions and 40.0 mL of zinc sulphate solution. Measure the emf value for each concentration of $[Cu^{2+}]$ ions. Record your readings in the given table. *Show the emf reading of the cell consisting of solution '**E**' and 0.1 M zinc sulphate solution to the **Visiting Examiner.***

Observation Table:

Sl. No.	Solution	$[Cu^{2+}]$ (M)	-log $[Cu^{2+}]$	emf (volt)
1	**A**	10^{-1}		
2	**B**	10^{-3}		
3	**C**	10^{-5}		
4	**D**	10^{-6}		
5	**E**			

(a) Based on the above experiment, answer the following questions.

(i) Plot a graph of – log $[Cu^{2+}]$ ions along *x*–axis and emf value along y-axis.



State the principle.

(ii) Draw a labelled diagram of the electrochemical cell.

(iii) Write the cell reaction.

(iv) Determine the unknown concentration of solution $CuSO_4$ (**E**) from the graph.

Question 3 **[5]**

Analyze qualitatively the substance **C-7** which contains two cations. Identify these cations.

Show one confirmatory observation of a cation to the ***Visiting Examiner.***

While testing for cations you must mention:

(i) How the original solution for group analysis was prepared

(ii) The formal group with pertinent group reagents

(iii) One confirmatory test for each cation

Note:

1. Use of qualitative analysis booklets/tables are not allowed.
2. Tabulate the experiment, observation and inference as per the example given below.
3. If the *experiment* is incorrect, no marks will be awarded for the *observation* and *inference*.

Sl. No.	Experiment	Observation	Inference

For Rough Work

For Rough Work

For Rough Work