Index No.:_____ AM06/I.24m

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

ADVANCED MATRICULATION LEVEL
2024 FIRST SESSION

SUBJECT:	**Chemistry**
PAPER NUMBER:	I
DATE:	22nd May 2024
TIME:	9:00 a.m. to 12:05 p.m.

Required Data: Relative atomic masses (RAM): H = 1, C = 12, O =16
Molar Gas Constant, R = 8.31 J mol^{-1} K^{-1}

Answer ALL questions

1. a) Write the electronic configuration, in terms of orbitals, for each of the following atoms:

H _____

C _____

Cl _____ (3)

b) Considering your answer to part (a), explain how the carbon atom in the ethene molecule forms four bonds.

_____

_____

_____

_____

_____

_____ (3)

c) The table shows the m/z values and corresponding relative abundance formed by molecules of CH_3Cl in a purified aerosol sample.

m/z	50	52
Relative abundance	68	22

Please turn the page.

i) Calculate the relative molecular mass of CH_3Cl.

_____

_____

_____ (2)

ii) Explain why CH_3Cl gives more than one parent peak when analysed with the mass spectrometer.

_____

_____

_____

_____ (2)

(Total: 10 marks)

2. a) Explain why SiO_2 is a solid at room temperature with a high melting point, whilst CO_2 is a gas.

_____

_____

_____

_____ (2)

b) Consider the following compounds;

$CH_3OCH_2CH_3$ PCl_3 NH_2OH CH_3COOH PbH_4 CO_2

Identify the compound(s) for which the strongest intermolecular forces are best described as:

i) hydrogen bonds _____

ii) permanent dipole – permanent dipole attractions _____

iii) induced dipole – induced dipole attractions _____(3)

c) PCl_3 and BCl_3 are both covalent trichlorides. Draw the shape of their molecules and use the VSEPR theory to explain these shapes.

_____

_____

_____

_____

_____ (3)

d) Draw the Lewis structure of the $AlCl_3$ molecule and explain why the molecule can also exist as a dimer.

_____

_____

_____

_____ (2)

(Total: 10 marks)

3. This question is about periodicity.

a) Describe the change in the first ionisation energy of the elements across period 3.

_____

_____

_____

_____

_____ (2)

Please turn the page.

b) Briefly describe and explain the difference in conductivity between aqueous NaCl and liquid PCl_3.

_____

_____

_____

_____

_____ (3)

c) Using equations, demonstrate how the oxides Na_2O and SiO_2 differ in their acidic/basic character.

_____

_____

_____

_____ (3)

d) Aluminium hydroxide is amphoteric. Write equations to demonstrate this property.

_____

_____

_____ (2)

(Total: 10 marks)

4. a) A mass of 0.51 g of a volatile alcohol was heated to 70 ^oC at a pressure of 101, 500 Pa in a gas chamber having a volume of 450 cm^3.

i) Find the molar mass of the alcohol.

_____

_____

_____

_____

_____ (3)

ii) It was found that the percentages by mass of carbon and hydrogen in the alcohol are 37.5 % and 12.5 %, respectively. Find the empirical formula of the alcohol.

_____

_____

_____

_____

_____ (2)

iii) Propose a molecular formula for the alcohol.

_____ (1)

b) To the alcohol vapour in the gas chamber in part (a), 0.040 moles of oxygen gas were added, and the alcohol vapour was completely combusted. Calculate the total pressure in Pa measured in the gas chamber after the gas chamber was allowed to cool to 293 K.

_____

_____

_____

_____

_____

_____ (4)

(Total: 10 marks)

5. a) Consider the following reaction at equilibrium:

$$N_2\,(g) + 3H_2\,(g) \rightleftharpoons 2NH_3\,(g)$$

The numerical value of the equilibrium constant K_C for this reaction at a given temperature is 4.0×10^{-3}.

i) Write the expression for the equilibrium constant K_C for this reaction and give its units.

_____

_____

_____

_____ (2)

Please turn the page.

ii) If the nitrogen and hydrogen concentrations at equilibrium are 0.020 mol dm^{-3} and 0.050 mol $dm^{-3,}$ respectively, calculate the equilibrium concentration of ammonia.

_____

_____

_____

_____ (2)

iii) If the volume of the container is doubled while keeping the temperature constant, describe how the value of K_C is affected.

_____

_____ (1)

b) Consider the following enzymatic reaction, which takes place in three steps as described below. ES represents the complex formed between the enzyme, E and the substrate, S. An oxidation reaction takes place in Step 2, and in Step 3, the ESO_2 complex dissociates to give the product, P and the enzyme, E.

Step 1: $E + S \rightleftharpoons ES$
Step 2: $ES + O_2 \rightleftharpoons ESO_2$
Step 3: $ESO_2 \rightleftharpoons E + P$

The equilibrium constants for Steps 1, 2, and 3 are K_1, K_2, and K_3, respectively.

i) Given that the overall equilibrium constant $K = K_1 \times K_2 \times K_3$, find the expression for the overall equilibrium constant, K.

_____

_____

_____

_____

_____

_____

_____ (4)

ii) Considering the overall expression for K derived in part (i), suggest an equation for the overall reaction.

_____ (1)

iii) What is the function of the enzyme E? Justify your answer.

_____

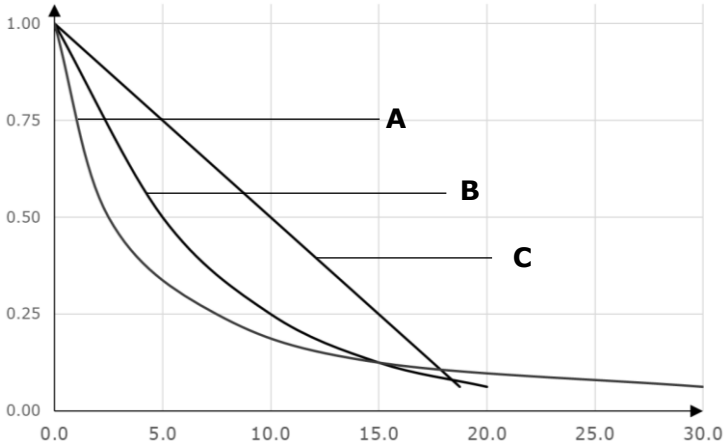
_____ (2)

(Total: 12 marks)

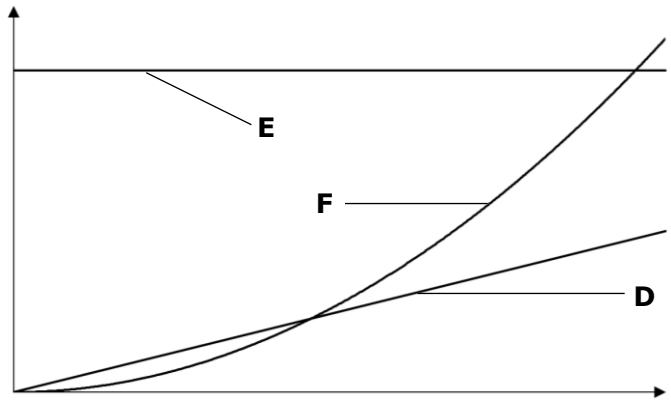
6. This question is about rates of reaction.

a) Below, you are provided with two plots labelled **X** and **Y**. Each plot contains three graphs representing a zero-order reaction, a first-order reaction and a second-order reaction.

Plot **X**



Plot **Y**



Please turn the page.

i) Label the axes in plots **X** and **Y** using the following terms. Each term may be used once, more than once or not at all. (2)

concentration of reactants rate of reaction time ln (rate)

concentration of products ln (concentration of reactants)

ii) Complete the following table to indicate which graphs represent a zero-order, first-order, and second-order reaction. (3)

Plot	Order of Reaction
A	
B	
C	
D	
E	
F	

b) Determine the numerical value of the half-life of the first-order reaction given in part (a). Explain your answer.

_____

_____

_____ (2)

c) Describe a mechanism for an inorganic reaction consistent with plot **F**. Explain your answer. In your answer, include the rate expression for the proposed mechanism.

_____

_____

_____

_____

_____

_____

_____ (5)

(Total: 12 marks)

7) a) Bromoethane can be converted to a three-carbon primary alcohol, **A**. Give a scheme, including reagents and conditions, to show how this synthesis can be carried out.

(4)

b) Ethanal can be converted to a three-carbon secondary alcohol, **B**. Give the name of **B** and the structure of the reagent required.

_____ (2)

c) **A** and **B** can both undergo oxidation to compounds **C** and **D,** respectively with the formula C_3H_6O.

i) Give the display formula of the products **C** and **D**.

(2)

ii) Give the conditions required to change **A** into **C**.

_____

_____ (1)

d) Describe a test to distinguish between **C** and **D,** indicating reagents and observations in each case.

_____

_____

_____

_____ (2)

(Total: 11 marks)

Please turn the page.

8) This question is about aromatic chemistry.

a) In the space provided, describe, using appropriate canonical structures, why benzenamine undergoes electrophilic substitution in specific positions.

_____

_____

_____ (5)

b) Chlorobenzene can be prepared in two ways.

i) Give an equation showing the conditions for the preparation of chlorobenzene directly from benzene.

_____ (2)

ii) Give an equation showing the conditions for the preparation of chlorobenzene from a diazonium salt.

_____ (2)

c) Benzaldehyde reacts with NaOH to give two products. Give the systematic name of the two products.

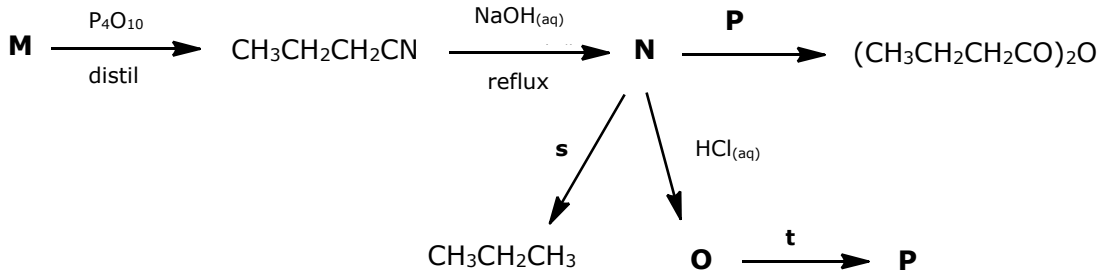
_____ (2)

d) Give the systematic name or structure of the product formed when benzamide is dehydrated.

_____ (1)

(Total: 12 marks)

9) This question is about the scheme shown below.



a) Give the structures of the organic compounds **M, N, O,** and **P.**

_____

_____

_____

_____ (4)

b) Identify reagents and conditions **s** and **t**.

_____

_____ (2)

c) Substances like **N**, but with a longer hydrocarbon chain, have a particular use. What is this use?

_____ (1)

d) It is difficult to observe the solubility of compounds **P** and $(CH_3CH_2CH_2CO)_2O$ in water, but when mixed with water, one of them gives a visible change. Explain.

_____

_____

_____

_____

_____ (3)

Please turn the page.

e) Describe **THREE** ways in which HCOOH reacts differently from other carboxylic acids.

_____

_____

_____

_____

_____

_____ (3)

(Total: 13 marks)

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

ADVANCED MATRICULATION LEVEL
2024 FIRST SESSION

SUBJECT:	**Chemistry**
PAPER NUMBER:	II
DATE:	23rd May 2024
TIME:	9:00 a.m. to 12:05 p.m.

A Periodic Table is provided.
Faraday's Constant = 96500 C mol^{-1}

Answer TWO questions from each section and ANY other question.

SECTION A

1. This question is about ionic equilibria.
   a) i) Calculate the pH of an aqueous vinegar containing 0.010 mol dm^{-3} ethanoic acid, given that the K_a value for ethanoic acid is 1.76 x 10^{-5} at 25 °C. Indicate any assumptions considered in the calculation. (4)
   ii) The value of K_w for pure water at 10 °C is 2.90 x 10^{-15} mol^2 dm^{-6}. Calculate the pH of pure water at 10 °C to two places of decimal. Show you working. (2)
   iii) When stored in a refrigerator at 10 °C, the $[H^+]$ ions of the vinegar solution in part (i) was measured at 4.17 x 10^{-4} mol dm^{-3}. Calculate K_b for the ethanoate ion at 10 °C. (4)

   b) With the aid of chemical equations, explain the amphoteric nature of the hydrogencarbonate ion. (4)

   c) Explain how an alkaline buffer system keeps the pH of a solution relatively stable on the addition of small amounts of acid and alkali. Your answer should include an example of an alkaline buffer system and relevant chemical equations. (6)

(Total: 20 marks)

2. This question is about organic chemistry.
   a) Alkanes do not react with nucleophiles or electrophiles. They only react with a specific type of species. Explain these two statements and give an example of a reaction involving alkanes. (3)

   b) Describe the mechanism for the monochlorination of cyclohexane. (6)

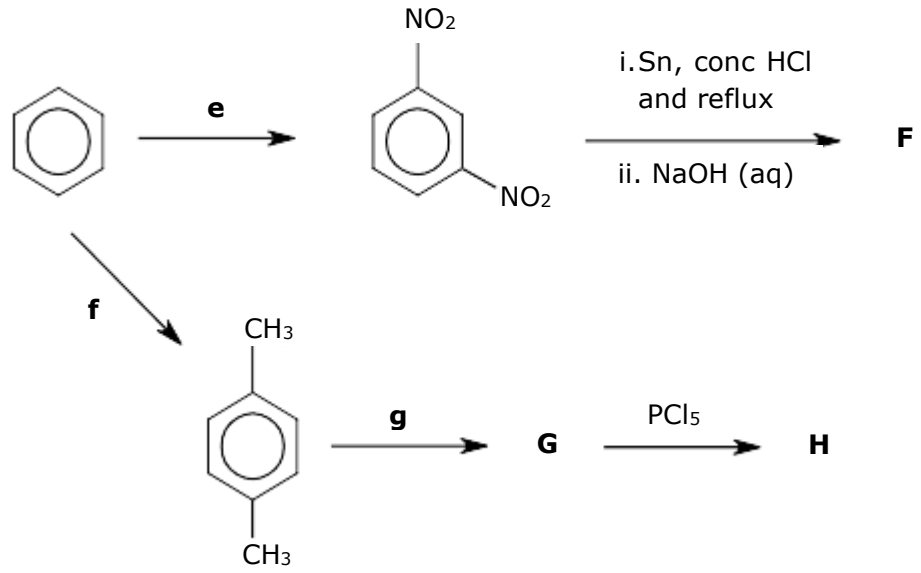
   c) Ammonia, ethanamine and benzenamine dissolved in water exhibit basic properties that are influenced by their structure. Explain this statement. (6)

   d) Alkenes show a specific type of stereoisomerism related to the double bond. Explain, including relevant structures to support your answer. (5)

(Total: 20 marks)

Please turn the page.

3. This question deals with organic chemistry. Consider the following reaction scheme: **F**, **G** and **H** are organic compounds, and **e**, **f** and **g** are reagents and conditions. Dissolving compound **G** in hot water forms a solution with a pH <7.



a) Give the systematic name of compound **F.** (1)
b) Complete the reaction scheme by giving the structures of organic compounds **G**, and **H**. (2)
c) Give the reagents and conditions for steps **e**, **f**, and **g**. (5)
d) Explain why compound **G** has low solubility in water. (2)
e) **I** is an isomer of compound **G** that can undergo dehydration by heating to form **J**.
   i) Give the structures of the isomer **I** and compound **J**. (2)
   ii) Explain why the reaction is **not** possible for compound **G**. (1)
f) **F** and **H** can react to form a polymer. Give the type of polymerisation involved, the type of polymer formed and the structure of the repeating unit. (3)
g) The polymer mentioned in part (f) is similar to a natural polymer, with both polymers having a similar repeated linkage. Give the name of the type of natural polymer and the linkage involved. (2)
h) **G** is used in the formation of another polymer called PET when it reacts with compound **K**. Give the name of compound **K** and **ONE** use for this polymer. (2)

(Total: 20 marks)

4. This question deals with energetics and redox equilibria.

a) Octane is a component of gasoline fuel. The standard enthalpy change of formation of water, carbon dioxide, and octane are given in the Table below.

	ΔH°_f (kJ mol^{-1})
H_2O (l)	-285.8
CO_2 (g)	-393.5
Octane (l)	-249.7

   i) Use the data provided to draw a Hess' cycle and calculate the standard enthalpy of combustion of octane with all reactants and products under standard conditions. (4)
   ii) Calculate the energy released from burning 1.0 kg of octane fuel under standard conditions. (2)

b) Lithium-ion batteries are galvanic cells that transfer lithium ions and electrons from the anode to the cathode. The cathode in lithium-ion cells is made of lithium cobalt oxide ($LiCoO_2$), and the anode is made of graphite.

Half-equation	$E^\ominus$ (V)
$Li^+ + e^- \rightleftharpoons Li$	−3.04
$Li^+ + CoO_2 + e^- \leftrightharpoons LiCoO_2$	+0.56

i) Give the equation for the reaction taking place at the anode and at the cathode. (2)
ii) Give the equation for the overall spontaneous reaction. (1)
iii) Calculate the standard electrode potential, $E^\ominus$, for the lithium-ion galvanic cell. (1)
iv) Calculate the standard free energy change for the reaction taking place in the lithium-ion cell. (2)

c) Given that the molar entropy change for the reaction in the lithium-ion battery is 5.7 J mol^{-1} K^{-1}, calculate the enthalpy change for the reaction at 25 °C per kilogram lithium metal. (3)

d) i) Lithium-ion batteries only contain 3 % of lithium metal by mass. Use your answer to part (c) to estimate the maximum energy that a 1.0 kg lithium-ion battery can give off, assuming standard conditions and no energy losses. (1)
ii) Use your knowledge of galvanic cells to suggest **ONE** reason why most of the mass of lithium-ion batteries is **not** made up of lithium metal. (1)
iii) Use your answer to part (a) to determine the better energy source between octane and lithium-ion batteries per unit mass. Suggest **ONE** reason for your answer. (2)
iv) List **ONE** environmental advantage of using lithium-ion batteries over octane as an energy source. (1)

(Total: 20 marks)

SECTION B

5. This question deals with the chemistry of copper and stoichiometry.

a) Explain why complexes of Cu(II) are coloured while those of Cu(I) are **not**. (2)
b) Copper may interact with ligands to form complexes. A complex may have an overall positive charge, negative charge or no charge. Explain this statement and give the name and formula of **TWO** specific examples of complexes of copper with a positive and a negative charge. (4)

c) A sample of the double salt $Cu_w(NH_4)_x(SO_4)_y.zH_2O$ was analysed as follows to identify the values of *w*, *x*, *y*, and *z* and identify the formula of the double salt.
i) A 10.0 g sample of this salt was dissolved in 500 cm^3 of solution. On heating 50.0 cm^3 of this solution with excess potassium iodide, the iodine formed reacted with 25.0 cm^3 of 0.100 mol dm^{-3} sodium thiosulfate. Calculate the percentage by mass copper in the salt. (5)
ii) Another 3.00 g sample of the salt was dissolved in excess sodium hydroxide. The ammonia released was absorbed into a cooled flask containing 50.0 cm^3 of 0.500 mol dm^{-3} hydrochloric acid. The resulting solution required 10.0 cm^3 of 1.00 mol dm^{-3} sodium hydroxide for neutralisation. Calculate the percentage by mass of ammonium ions in the salt. (4)

Please turn the page.

iii) Another sample of 1.00 g of the salt was dissolved in water, and excess barium chloride was added. The mass of the dried precipitate resulted to be 1.165 g. Calculate the percentage by mass of sulfate ions in the salt. (2)

iv) Use the information obtained in parts (i) to (iii) to calculate the value of *w*, *x*, *y*, and *z* and hence find the formula of the double salt. (3)

(Total: 20 marks)

6. a) Discuss the trends in solubility of the Group 2 sulfates and hydroxides. (5)

b) Outline, with the aid of chemical equations, how hydrogen can be synthesized in the laboratory from;

i) sulfuric acid; (2)

ii) methanol. (2)

c) Sulfur exists in many allotropic forms.

i) Define the term allotrope, name **TWO** allotropic forms of sulfur and describe the effect of temperature on these allotropes. (3)

ii) Suggest why allotropes of oxygen can be distinguished by chemical means while those of sulfur cannot. (2)

d) Explain why the addition of potassium iodide to a saturated aqueous solution of iodine increases the solubility of the halogen, whilst the addition of potassium iodide to a saturated solution of PbI_2 decreases the solubility of the salt. In your answer, include relevant chemical equations. (6)

(Total: 20 marks)

7. This question is about phase equilibria and the chemistry of nitrogen.

a) "An ideal mixture of two volatile liquids is one that obeys Raoult's Law. But there is actually no such thing as an ideal mixture. However, some liquid mixtures get fairly close to being ideal".

i) Explain the term "ideal mixture" in the context of Raoult's Law. (2)

ii) State Raoult's Law. Give the equation that portrays this relationship, indicating what each symbol represents. (3)

iii) The saturated vapour pressure of trichloromethane ($CHCl_3$) and dichloromethane (CH_2Cl_2) at 298 K are 200 mmHg and 415 mmHg, respectively. Work out the mole fractions of each component in the vapour phase and hence calculate the total vapour pressure above the solution prepared by mixing 25.5 g of trichloromethane and 40 g of dichloromethane at 298 K. (5)

iv) Give an example of a liquid binary mixture that shows negative deviation from Raoult's Law and explain what happens to the temperature on mixing the two components. (3)

b) i) Using a Lewis structure, describe how nitrogen dioxide is a source of free radicals. (2)

ii) Suggest why the concentration of nitrogen dioxide in the air increases rapidly with morning traffic. Explain your answer. (2)

iii) Write an equation for the reaction of nitrogen dioxide with water. State what type of reaction this is and explain your answer. (3)

(Total: 20 marks)

8. a) Carbon, silicon, and lead can form stable chlorides at room temperature.
   i) Give the formula and describe the bonding of these stable chlorides. (3)
   ii) Describe the action of water on these chlorides, giving reasons for any differences. (4)

   b) Explain why tetraethyllead was used in petrol engines and why it has been phased out. (3)

   c) Compound **P** is a liquid with a boiling point of 80 °C. It forms an orange 2,4-dinitrophenylhydrazone solid derivative, and a pale-yellow solid with iodine and sodium hydroxide. The mass spectrum of compound **P** is shown in Figure 1, and the high-resolution ^{1}H NMR spectrum is shown in Figure 2 below. The peak integration data is given above each peak in Figure 2.

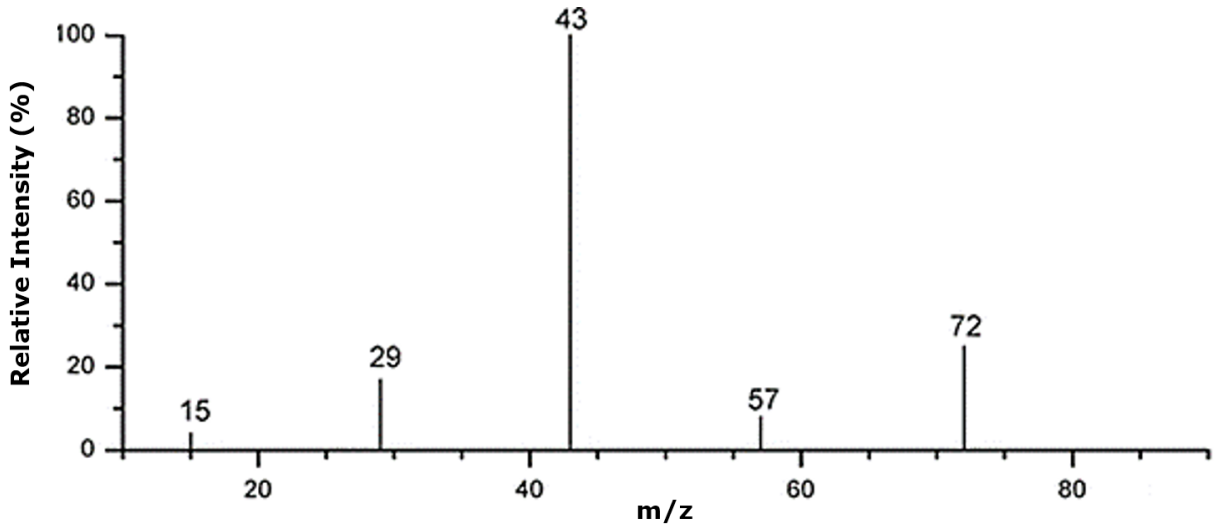


Figure 1: Mass spectrum of compound **P**

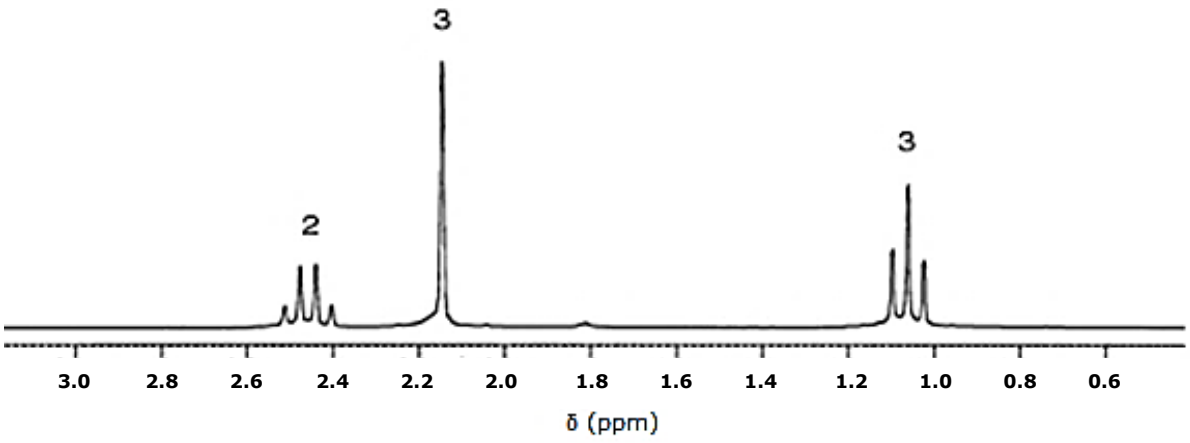


Figure 2: High-resolution ^{1}H NMR of compound **P**

   i) Use the information given to deduce the identity of the unknown compound **P,** clearly explaining how you deduced your answer. (7)
   ii) Give the structure of the orange 2,4-dinitrophenylhydrazone derivative formed and an equation for the formation of the pale-yellow precipitate with iodine and alkali. (3)

(Total: 20 marks)

Index No.:_____ AM06/III.24m

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

ADVANCED MATRICULATION LEVEL
2024 FIRST SESSION

SUBJECT:	**Chemistry**
PAPER NUMBER:	III – *Practical*
DATE:	13th June 2024
TIME:	3 hours and 5 minutes

1. You are provided with three solutions as follows:

   i) A solution of sodium hydroxide, labelled $\mathbf{L_n}$;
   ii) A solution of ethanedioic acid of concentration 0.100 mol dm^{-3}, labelled **Z**;
   iii) A solution of ethanoic acid labelled **M**.

In this experiment, you are required to use a titrimetric method to determine the molar concentration of solution **M**.

a) Record the value of your laboratory number, n (found on solution **L**), on your answer book in the following box.

CANDIDATE LABORATORY NUMBER, n:.....

Determination of the molar concentration of solution L_n

b) Fill the burette with solution $\mathbf{L_n}$. Using a suitably rinsed pipette, transfer 25.0 cm^3 of solution **Z** into a conical flask, add three drops of phenolphthalein indicator, and titrate to a pink endpoint.

	1st Titration	2nd Titration	3rd Titration
Final burette reading			
Initial burette reading			
Titre (cm^3)			

Mean titre: _____ cm^3 of solution $\mathbf{L_n}$.

(20)

c) Ethanedioic acid and sodium hydroxide react as follows:

$$(COOH)_2\ (aq) + 2NaOH\ (aq) \rightarrow (COONa)_2\ (aq) + 2H_2O\ (l)$$

Calculate the concentration of solution $\mathbf{L_n}$ using the stoichiometry of this reaction and your data from part (b).

_____

_____

_____

_____

_____

_____

_____

_____

(4)

Determination of the molar concentration of solution M

d) Transfer 25.0 cm^3 of solution **M** into a 250 cm^3 volumetric flask using a suitably rinsed pipette. Make up the volume to the mark with distilled water and shake the volumetric flask to homogenise the solution. Label the diluted solution, **dM**.

Fill the burette with solution $\mathbf{L}_n$. Using a suitably rinsed pipette, transfer 25.0 cm^3 of solution **dM** into a conical flask, add three drops of phenolphthalein indicator, and titrate to a pink endpoint.

	1st Titration	2nd Titration	3rd Titration
Final burette reading			
Initial burette reading			
Titre (cm^3)			

Mean titre: _____ cm^3 of solution $\mathbf{L_n}$.

(20)

e) Ethanoic acid and sodium hydroxide react as follows:

$$CH_3COOH\ (aq) + NaOH\ (aq) \rightarrow CH_3COONa\ (aq) + H_2O\ (l)$$

Calculate the molar concentration of solution **M.**

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(Total: 50 marks)

2. You are provided with two solutions, **C** and **D,** each of which is a solution of an inorganic salt in water. Carry out the tests described below and attempt to identify the inorganic salts in the solutions.

a) To about 1 cm^3 of solution **C** in a boiling tube**,** add a few drops of sodium hydroxide solution, followed by excess. Then, add a piece of aluminium foil and heat the resulting mixture.

Observation *Inference*

(5)

b) To about 1 cm^3 of solution **C**, add a few drops of ammonia solution, followed by excess.

Observation *Inference*

(3)

c) To about 1 cm^3 of solution **C,** add a few drops of potassium manganate(VII) solution.

Observation *Inference*

_____ _____

_____ _____

_____ _____

(3)

d) To about 1 cm^3 of solution **C,** add an equal volume of dilute hydrochloric acid solution.

Observation *Inference*

_____ _____

_____ _____

_____ _____

(3)

e) To about 1 cm^3 of solution **D**, add a few drops of sodium hydroxide solution, followed by excess.

Observation *Inference*

_____ _____

_____ _____

_____ _____

_____ _____

(3)

f) To about 1 cm^3 of solution **D**, add a few drops of ammonia solution, followed by excess.

Observation *Inference*

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

(4)

g) To about 1 cm^3 of solution **D**, add a few drops of potassium hexacyanoferrate(II) solution.

Observation	*Inference*
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

(3)

h) To about 1 cm^3 of solution **D**, add a few drops of barium chloride solution followed by 1 cm^3 of dilute hydrochloric acid solution.

Observation	*Inference*
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

(4)

Conclusion

Suggest a possible identity for substance **C**: _____ (1)

Suggest a possible identity for substance **D**: _____ (1)

(Total: 30 marks)

3. Substance **X** is an organic solid. Carry out tests as described below and suggest a plausible chemical structure for this compound.

a) Add a tip of a spatula of **X** to 1 cm^3 of neutral iron(III) chloride solution.

Observation	*Inference*
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

(3)

b) In a **dry** boiling tube, mix a tip of a spatula of **X** with approximately an equal quantity of sodalime and heat vigorously on a Bunsen flame. **Carefully** note the odour of any vapours released and test with moist litmus paper.

Observation	*Inference*
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

(5)

c) Dissolve your remaining sample of **X** in about 15 cm^3 of water. ***Retain this solution for subsequent tests***.

Observation *Inference*

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

(2)

d) Dissolve a tip of a spatula of sodium nitrate(III) in 2 cm^3 of distilled water in a test tube. Add 2 cm^3 of the aqueous solution of **X** obtained in test (c) to a clean boiling tube, followed by 2 cm^3 of dilute hydrochloric acid. Cool the two solutions in an ice-water bath for two minutes. Then, add the cold sodium nitrate(III) solution to the boiling tube and shake the resulting mixture.

NOTE: Dispose of your solution immediately after the test has been carried out, and rinse the boiling tube with tap water.

Observation *Inference*

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

(5)

e) To about 1 cm^3 of the aqueous solution of **X** obtained in test (c), add 1 cm^3 of bromine solution and shake.

Observation	*Inference*
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

(2)

Conclusion

A possible structure for **X** is: _____ (3)

(Total: 20 marks)

Blank Page

Blank Page

Blank Page