

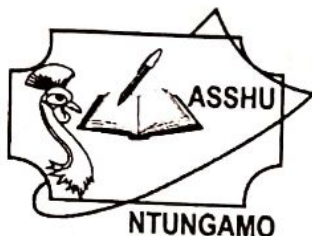
P525/2

Chemistry

PAPER 2

JULY/AUGUST 2023

2 HOURS 30 MINUTES



**ASSOCIATION OF SECONDARY SCHOOLS HEADTEACHERS OF UGANDA
(ASSHU) NTUNGAMO**

Uganda Advanced Certificate of Education

CHEMISTRY

PAPER 2

2 HOURS 30 MINUTES

Instructions to candidates:

- Answer 5 questions including 3 questions from **Section A** and 2 questions from **Section B**.
- Begin each question on a fresh page.

1. A compound **L** contains 76.32% carbon, 6.38% hydrogen and the rest being oxygen.
An aqueous solution of **L** is acidic but does not liberate carbon dioxide from carbonate.
A solution of 1.5g of benzene freezes at 1.3°C .
(Freezing point of benzene = 5.5°C , K_f for benzene = $5.12^{\circ}\text{C mol}^{-1}\text{Kg}^{-1}$)

(a) Determine the;

(i) Empirical formula of **L**.

(2 mks)

(ii) Molecular formula and write the structural formula of **L**.

(4 mks)

(b) Explain why an aqueous solution of **L** is acidic.

(2 mks)

(c) Describe the reaction of **L** with;

(i) Sodium hydroxide solution

(2 mks)

(ii) Bromine water

(2 mks)

Write the equation for the reaction in each case

(d) Write the equation and outline the mechanism for the reaction between **L** and ethanoyl chloride in the presence of Sodium Hydroxide.

(3 mks)

(e) Write equations to show how **L** can be prepared from benzene.

(3 mks)

(f) Name the reagent used to test for **L** and state what is observed.

(2 mks)

2. (a) (i) Define "Partition coefficient"

(1 mk)

(ii) State the conditions under which the law is valid.

(1 mk)

(b) Describe an experiment to find the partition coefficient of butanedioic acid (succinic acid) between ethoxyethane and water.

(2 mks)

(c) 50 cm^3 of an aqueous solution containing 6g of **X** was in equilibrium with 100 cm^3 of ethoxyethane containing 108g of **X**.
Calculate the partition coefficient.

(2 mks)

- (d) Calculate the mass of X extracted by shaking 100 cm³ of an aqueous solution containing 10g of X with;
- 100 cm³ of ethoxyethane. (4 mks)
 - Two portions of 50 cm³ of ethoxyethane

- (e) The table below shows the partitioning of methylamine between 0.1M copper (II) Sulphate solution and trichloromethane.

(CH ₃ NH ₂) in 0.1M CuSO ₄	0.86	1.30	1.74	2.18
(CH ₃ NH ₂) in CHCl ₃	0.02	0.04	0.06	0.08

- Plot a graph of concentration of methylamine in 0.1M Copper (II) Sulphate against concentration of methylamine in trichloromethane. (3 mks)
- Determine the formula of the complex formed. (2 mks)
- Write the equation for the reaction that took place between Copper (II) Sulphate and methylamine. (1 mk)

3. The elements carbon, silicon, tin and lead are group (IV) elements.

- Give 3 reasons why carbon differs from other members of the group. (1½ mks)
 - State 4 properties that distinguish carbon from other members of the group. (2 mks)
- Describe the reactions of these elements with water. (6 mks)
- Explain the trend in acidity of the dioxides of the elements. Use the reactions with Sodium Hydroxide to illustrate your answer. (5 mks)
- Describe the reactions of the tetrachlorides of group (IV) elements with water. (3½ mks)
- Write the equation for the reaction between Lead (IV) Oxide and;
 - Cold concentrated hydrochloric acid (1 mk)
 - Hot concentrated Sodium Hydroxide (1 mk)

4. Explain the following observations.

5


Write equations for the reactions where necessary;

- (a) When Sodium Hydroxide solution is added to an aqueous solution of Potassium Chromium (III) Sulphate, a green precipitate is formed which dissolves in excess alkali to form a green solution. The solution changes to yellow when heated with Hydrogen Peroxide solution. (6½ mk)
- (b) An aqueous solution of 0.01M Sodium Chloride and 0.02M solution of urea have the same freezing points. (3 mk)
- (c) Hydrogen fluoride is a liquid at 20°C whereas Hydrogen Chloride is a gas. (4mks)
- (d) When Sodium Hydroxide is added to a solution of Manganese (II) Chloride, a white precipitate is formed which quickly changes to brown. The precipitate is insoluble in excess Sodium Hydroxide. (4½ mks)
- (e) When a solution of Manganese (II) Chloride is heated with Lead (IV) oxide and concentrated nitric acid, the solution changes to purple. (2 mks)

SECTION B
(Answer 2 questions only)

5. Write equations to show how the following compounds can be synthesized indicate the reagents and conditions.

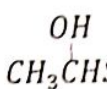
(a) Benzaldehyde (Phenylmethanal) from phenol. (3 mks)

(b)  -NHCH₃ from Benzene (3 mks)

(c) Cyclohexanone from cyclohexene (2½ mks)

(d) (CH₃)₂C = NNHCONH₂ from ethyne (3½ mks)

(e) CH₃CH₂CO₂CH₂CH₃ from ethene (3½ mks)

(f)  from ethyne (2 mks)

(g) Propanone from ethanol (2½ mks)

6. Beryllium, Magnesium, Strontium and Barium are in group (II) of the periodic table.

(a) Explain the trend in metallic character. (3 mks)

(b) Describe the reaction of group (II) elements with;

(i) Water (4 mks)

(ii) Sulphuric acid (4 mks)

Write equations for the reactions that take place.

(c) Write the equation for the reaction that takes place between Beryllium and Sodium hydroxide. (1 mk)

(d) Draw a born Baber cycle for the solubility of a group (II) metal hydroxide. (2 mks)

(e) Explain the trend in the solubility of the group (II) metal hydroxides. (4 mks)

7. (a) Define;

(i) Conductivity

(1 mk)

(ii) Molar conductivity

(1 mk)

(b) Draw a sketch graph to show how the molar conductivity varies with concentration for;

(i) Ammonium chloride

(2mks)

(ii) Ammonia solution

(2mks)

(c) 25cm^3 of 0.1M hydrochloric acid was titrated with ammonia solution.

(i) Draw a sketch graph to show how the conductivity of the solution changes when ammonia solution was added to the acid.

(2 mks)

(ii) Explain the shape of the curve.

(4 mks)

(d) The conductivity of $1.6 \times 10^{-2}\text{M}$ solution of ethanoic acid at 20°C is $1.96 \times 10^{-2}\text{sm}^{-1}$. Its molar conductivity at infinite dilution is $3.53 \times 10^{-2}\text{sm}^{-2}$.

Calculate the;

(i) Molar conductivity of the solution of ethanoic acid at 20°C .

(1½ mks)

(ii) Ionization constant.

(2 mks)

8. (a) (i) What is an ore?

(1 mk)

(ii) Write the formula and name of one ore of copper.

(1 mk)

(b) Describe how;

(i) the ore of copper is concentrated.

(3 mks)

(ii) pure copper is obtained from the ore

(6 mks)

(c) Describe the reaction of Copper with Sulphuric acid.

(2 mks)

(d) Explain why an aqueous solution of Copper (II) Sulphate;

(i) is acidic

(2 mks)

(ii) reacts with concentrated hydrochloric acid to form a yellow solution.

(2 mks)

(f) Describe how the percentage of Copper in an impure ore is determined. (6 mks)

END