

P525/ 2
CHEMISTRY
Paper 2
MAY-JUNE-2023
2½hours



ACEITEKA JOINT MOCK EXAMINATIONS 2023

Uganda Advanced Certificate of Education

CHEMISTRY

PAPER 2

2 hours 30 minutes

INSTRUCTIONS TO THE CANDIDATES

Answer **five** questions including **three** questions in section **A** and any **two** questions in section **B**.

Write the answers in the answer booklet provided.

Mathematical tables and graph papers are provided.

Begin each question on a fresh page.

Non-programmable scientific electronic calculators may be used.

Illustrate your answers with equations where applicable.

Indicate the questions in the grid below.

Where necessary use C = 12 , O = 16 , H = 1 , Ca = 40, Ag = 108, P = 31

Question						Total
Marks						

1. (a) (i) Define the term **colligative property**. (01mark)
- (ii) State the **colligative properties** of a solution. (02marks)
- (b) (i) Describe how molecular mass of cane sugar can be determine using one of the colligative properties. (06marks)
- (ii) State limitations of the method used. (02marks)
- (c) The table below shows the freezing points of various solutions of cane sugar in solvent **X**.

Mass of cane sugar (g /1000g of solvent X)	26	42	66	78	118	148	173
Freezing point. (°C)	5.11	4.87	4.51	4.33	3.73	3.28	2.91

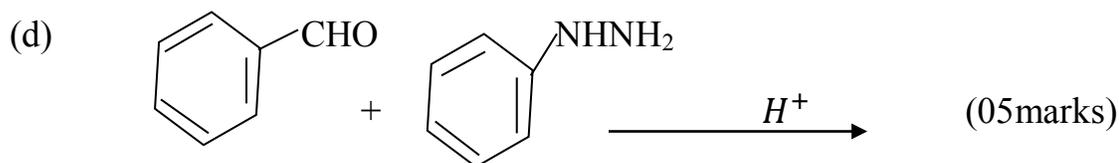
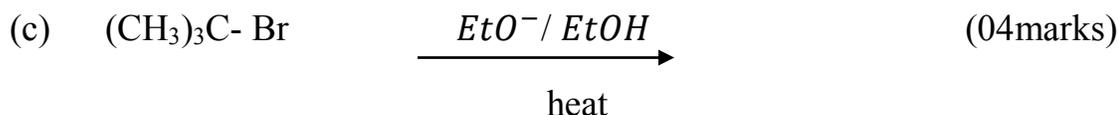
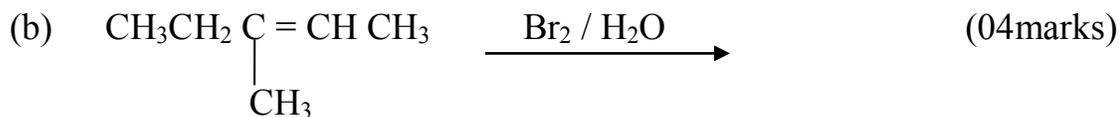
- (i) Plot a graph of freezing against mass of cane sugar and use graph to determine the: (03marks)
- (ii) Freezing point of solvent **X**. (01marks)
- (iii) Freezing point constant for solvent **X**. (02marks)
(RMM of cane sugar = 342)
- (d) State and explain how the freezing points of the solution would be affected if cane sugar associates in solution **X**. (03marks)
2. (a) Define the terms
- (i) conductivity (01mark)
- (ii) molar conductivity (01mark)
- (b) The table below shows the molar conductivities of an aqueous solution of sodium hydroxide.

Concentration (mol dm ⁻³)	0.01	0.04	0.09	0.16	0.25	0.36
Molar conductivity $\Lambda / \text{Scm}^2\text{mol}^{-1}$	238	230	224	217	210	202

- (i) Plot a graph of molar conductivity against square root of concentration. (3½marks)

- (ii) Use the graph to determine the molar conductivity of sodium hydroxide at infinity dilution. (01mark)
- (iii) Explain the shape of the graph. (03marks)
- (c) (i) Draw a sketch graph to show the change in the conductivity with volume of ammonia solution when 25cm³ of 0.1M methanoic acid is titrated with 0.1M ammonia solution. (02marks)
- (ii) Explain the shape of the graph. (3½marks)
- (d) The conductivity of a saturated solution of silver phosphate at 25°C is 2.661x 10⁻⁶Scm⁻¹ and that of pure water is 1.519 x 10⁻⁶Scm⁻¹. If the molar ionic conductivities of silver ions and phosphate ions at infinite dilution at 25°C are 61.9 and 240Scm²mol⁻¹ respectively. Calculate the
- (i) solubility of silver phosphate in molesdm⁻³ at 25°C. (2½marks)
- (ii) solubility product of silver phosphate at 25°C and state its units. (2½marks)
3. (a) Write the formulae of the chlorides of group(IV) elements. (3½marks)
- (b) State the condition (s) and write equation for the reaction to show the preparation of
- (i) the chloride of carbon (2½marks)
- (ii) the chloride of silicon (2½marks)
- (iii) the chlorides of lead (05marks)
- (c) Describe the reactions of chlorides of group elements with water. (6½marks)
4. Complete the following equations and in each case outline a mechanism for the reaction.





SECTION B

Answer **two** questions from this section.

5. (a) State
- Partition law. (01mark)
 - three** limitations of the law. (1½marks)
- (b) (i) Describe an experiment to determine the partition coefficient of phenol between ethoxyethane and water. (06marks)
- (ii) State **two** advantages and **one** disadvantage of using ethoxyethane in this experiment. (1½marks)
- (c) An aqueous solution contains 10g of phenol per litre. When 100cm³ of this solution is shaken with 20cm³ of ethoxyethane, the ethoxyethane layer extracts 0.8g of phenol. Calculate mass of phenol extracted when 500cm³ of the aqueous layer was shaken with
- 50cm³ of the ethoxyethane. (04marks)
 - two successive 25cm³ portions of the ethoxyethane. (04marks)

- (d) Comment on your results in (c) above. (02marks)
6. A Compound Y contains carbon, hydrogen and nitrogen only. On complete combustion, 2.325g of Y yielded 6.6g of carbon dioxide and 295.4cm³ of nitrogen gas measured at 15°C and at 760mmHg.
- (a) Calculate the empirical formula of Y. (05marks)
- (b) When compound was steam distilled at 97°C and 755mmHg, the distillate contained 45.49% by mass of Y. (The saturated vapour pressure of water at this temperature 650mmHg). Determine the molecular formula of Y. (3½marks)
- (c) Y burns with a sooty flame. Write the structural formula and name of Y. (01mark)
- (d) When Y treated with a mixture of concentrated hydrochloric acid and sodium nitrite solution at 5°C, compound Z was formed. State what would be observed and write equation for the reaction when
- (i) an alkaline solution of naphthalen – 2- ol was added to Z. (02marks)
- (ii) Z was warmed with acidified water. (02marks)
- (e) Using equations only show how
- (i) Y is prepared from benzene (03marks)
- (ii) Z can be converted to benzoic acid. (03marks)
7. Explain each of the following observations
- (a) When hydrogen peroxide was added to lead(II) sulphide, black solid turned white. (04marks)
- (b) Beryllium oxide is insoluble in nitric acid but soluble in sodium hydroxide solution. (04mark)

- (c) Carbonic acid (H_2CO_3) and sulphurous acid (H_2SO_3) are both weak acid but they exhibit different bond angles. (04marks)
- (d) When ammonia solution was added to nickel(II) sulphate solution, green precipitate was formed which dissolved to form a blue solution. (04marks)
- (e) When methanoic acid was warmed with Fehling's solution a red precipitate was formed whereas with ethanoic acid, there was no observable change. (04marks)
8. (a) Soap can be prepared from a vegetable oil or animal fat.
- (i) Distinguish between a vegetable oil and animal fat. (02marks)
- (ii) Briefly explain how vegetable oil can be extracted from a natural source. (03marks)
- (b) (i) Briefly describe how soap can be prepared from a vegetable oil. State the chemical principles involved. ($3\frac{1}{2}$ marks)
- (ii) Write equation for the reaction leading to the formation of soap. (01mark)
- (iii) State one advantage and one disadvantage of using soap.
- (iv) Briefly explain the cleansing action of soap. ($2\frac{1}{2}$ marks)
- (v) Explain why an aqueous solution of soap is alkaline. (02marks)
- (c) (i) Distinguish between soap and non-soapy detergent. (02mark)
- (ii) Starting from dodecan-1-ol write equations to show how you would prepare a detergent. (02marks)
- (iv) State one advantage and one disadvantage of using a detergent in washing. (02mark)

END