

P525/2

CHEMISTRY

Paper 2

July/August, 2022

2 ½ hours



## BUSOGA REGION JOINT EXAMINATION BOARD

UGANDA ADVANCED CERTIFICATE OF EDUCATION

CHEMISTRY

Paper 2

2 HOURS 30 MINUTES

### INSTRUCTIONS TO CANDIDATES

Answer **FIVE** questions including **THREE** questions in section **A** and **TWO** questions in section **B**.

Write your answers in the answer booklets provided.

Mathematical tables and graph papers are provided.

Begin each question on a fresh page

Non-programmable scientific calculators may be used.

Illustrate your answers with equations where applicable

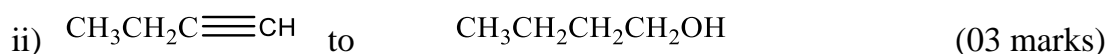
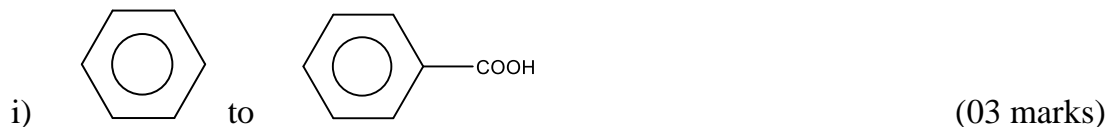
Where necessary, use the following values:

( $H = 1$ ,  $N = 14$ ,  $O = 16$ )

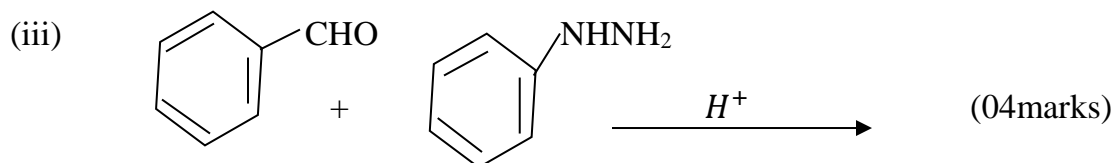
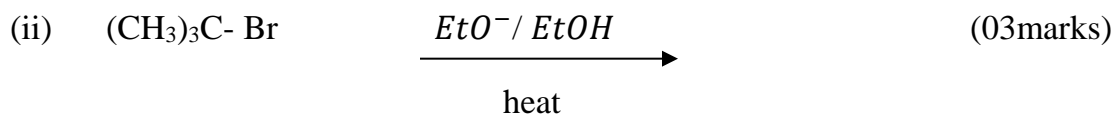
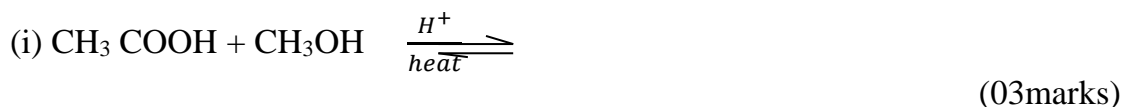
## SECTION A (60 MARKS)

Answer three questions from this section

1. a) Write equations to show how the following conversions can be effected



b) Complete the following equations and in each case outline a mechanism for the reaction.



2. (a) Write the valence configuration of group(II) elements. (01mark)

(b) Describe the reactions of group(II) elements with:

- (i) Water
- (ii) sulphuric acid
- (iii) Sodium hydroxide (15 marks)

(c) Potassium chromate solution was added to barium chloride solution followed by dilute nitric acid drop-wise until in excess.

- (i) State what was observed.
- (ii) Write equation(s) for the reaction(s) that took place. (04 marks)

3. (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 <b>X</b> )	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)
4. a) What is a weak acid (01 mark)
- (b) State and explain three factors that affect the PH of weak acids (03 marks)
- (c) The PH of aqueous solution of Methanoic acid, Ethanoic acid and Benzoic acid each of concentration 0.1M each are 2.39, 2.89 and 2.61 respectively.
- (i) Calculate the degree of ionization of each acid (03 marks)
- (ii) State and explain the order of the acid strength of the three acids (04 marks)
- (d) (i) 35 cm<sup>3</sup> of 0.089M sodium benzoate solution were added to 45cm<sup>3</sup> of 0.1M Benzoic acid. Calculate the PH of the resultant solution. State only assumptions made in your calculations. (06½ marks)  
(K<sub>a</sub> for Benzoic acid = 6.3 x 10<sup>-5</sup> mol dm<sup>-3</sup>)
- (ii) State and explain what would happen to the PH of the resultant solution in (d) (i) above when a small amount of dilute hydrochloric acid is added to it. (02 ½ marks)

## SECTION B: (40 MARKS)

Answer any **TWO** questions from this section.

5. Explain each of the following observations.

- (a) Transition metals of period 4 have higher melting point than non-transition metals of the same period. (03marks)
- (b) Sodium carbonate is used as a base in acid-base titration (03marks)
- (c) Enthalpy of solution of Hydrated copper (II) sulphate crystals is positive while that of anhydrous copper (II) sulphate is negative. (03marks)
- (d) Both aluminium oxide and silicon(IV) oxide dissolve in concentrated sodium hydroxide solution. (03marks)
- (e) When sodium hydroxide solution was added to cobalt(II) sulphate solution drop-wise until in excess blue precipitate was formed which was insoluble in excess and the precipitate turned brown on standing. (03marks)

6. (a) Define the following terms: (02 marks)

- (i) Standard electrode potential
- (ii) molar conductivity

(b) With the aid of a labeled diagram, describe how the standard electrode potential of magnesium metal in a solution of its ions can be measured. (06 marks)

(c) The standard electrode potentials of some two systems are.



- (i) Write equation for the cell reaction (01½ marks)
- (ii) Determine the e.m.f of the cell (01 mark)
- (iii) State whether the reaction in (c) (ii) above is possible or not and give a reason for your answer. (01 mark)
- (d) Explain any the factors that affect the magnitude of electrode potentials of a metal in a solution of its ions (04 marks)

(e) The table below shows the molar conductivities of an aqueous solution of sodium hydroxide.

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

- (i) Plot a graph of molar conductivity against dilution. (03½ marks)
- (iii) Use the graph to determine the molar conductivity of sodium hydroxide at infinity dilution. (01 mark)

7. (a) Soap can be prepared from a vegetable oil or animal fat.

- (i) Distinguish between a vegetable oil and animal fat. (02 marks)
- (ii) Briefly explain how soap can be manufactured starting from cotton seeds. State the chemical principles involved (05½ marks)
- (iii) Write equation for the reaction leading to the formation of soap.

(b) (i) Briefly explain the cleansing action of soap. (02½ marks)

- (ii) State one advantage and one disadvantage of using soap. (02 marks)
- (iii) Explain why it is not advised to use soap for washing aluminium utensils. (3marks)

(c) (i) Distinguish between addition polymers and condensation polymer (02marks)

- (ii) Give one example of each polymer in c(i) and write an equation

8. a) Define the term standard enthalpy of reaction (01 mark)

zinc displaces copper in from its compounds in aqueous solution

- (i) write an ionic equation for the reaction (01½ marks)
- (ii) explain how the enthalpy change for the reaction could be measured experimentally. Show how the results could be used to calculate the enthalpy of reaction (07 marks)

b) The enthalpy of formation of water, phosphorus oxide and phosphoric acid are given below (05 marks)

Compound	$\Delta H_f / \text{kJmol}$
$\text{P}_4\text{O}_{10}$	-2984
$\text{H}_2\text{O}$	-286
$\text{H}_3\text{PO}_4$	-1279

(i) Draw the enthalpy cycle to represent the information

(ii) Calculate the enthalpy change for the for the reaction

c) State the factors that affect the magnitude of lattice energy. Explain how each factor affects the magnitude of lattice energy (04 marks)

d) Explain why sodium chloride, unlike some metal chlorides is predominantly ionic (02½ marks)

**END**