



PROVINCIAL - NAMIREMBE DIOCESE
COUHEIA SECONDARY
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						

© COUHEIA 2023

"Restoring the church in Education"

TURN OVER

SECTION A: (60 marks)

Answer any three questions in this section.

1. a) Draw a fully labeled diagram to show arrangement of the apparatus you would use to measure the e.m.f of a cell consisting of silver and copper electrodes. Indicate the direction of flow of electrons (5marks)

b) Write:

i) the notation of the cell you would have drawn in a) and state the convention used. (3marks)

ii) The equation taking place at each electrode. (2marks)

iii) The overall cell reaction. (1½marks)

c) If the standard electrode potentials for copper/ copper (II) ions/silver ions are +0.35V and +0.81V respectively, calculate the e.m.f of the cell consisting of copper and silver electrodes.

(2marks)

d) Describe how the standard electrode potential of copper can be determined and

write the cell notation.

(6½marks)

2. A 25.0cm³ aliquot of 0.5M sodium hydroxide solution was boiled under reflux with 1.531g of an alkyl iodide, C_nH_{2n+1}I. After cooling, the mixture required 35cm³ of 0.1M hydrochloric acid for complete neutralization.

a) i) Calculate the molar mass of the alkyl iodide. (4marks)

ii) Determine the molecular formula and write the structural formulae of all possible isomers of the alkyl iodide. (4marks)

b) The organic product obtained by treatment of the alkyl iodide with sodium hydroxide was oxidized by chromium trioxide in the presence of concentrated sulphuric acid to give compound A, which reacts with hot iodine in the presence of sodium hydroxide solution.

State what was observed and write equation for:

i) The oxidation reaction leading to the formation of A. (2marks)

ii) The reaction between A and hot iodine in the presence of sodium hydroxide solution.

(2marks)

c) When the alkyl iodide was heated with a mixture of Ethanol and potassium hydroxide gas B was formed.

i) Write equation for the reaction and indicate its mechanism. (2marks)

ii) Show by means of equations how B could be converted to phenol. (Include conditions and reagents where necessary). (4marks)

3. a) Nitric acid (b.p= 86°C) and water (b.p= 100°C) form an azeotropic mixture with boiling point of 120°C and composition of 68.0% nitric acid, 32.0% water by mass.

i) Explain what is meant by the term azeotropic mixture. (2marks)

ii) Sketch a fully labeled boiling point composition diagram for a nitric acid-water mixture. (4marks)

iii) Explain carefully what happens when dilute nitric acid containing approximately 10% nitric acid by mass is fractionally distilled. (4marks)

iv) A nitric acid-water mixture shows a negative deviation from Raoult's law.

State the factors that contribute to this position from ideal behavior. (4marks)

b) i) State two characteristics which are suitable for steam distillation. (2marks)

ii) An aromatic compound Z was steam distilled at 98.6°C under one atmosphere pressure. The pressure of water at 98.6°C is 720mmHg, calculate the relative molecular mass of Z.

(4marks)

4. a) i) State two important oxidation states exhibited by carbon, silicon, tin and lead. (1mark)

ii) Describe how the stability of the two oxidation states varies from carbon to lead. (Use the oxides of the elements to illustrate your answer). (8marks)

b) State what would happen if tetrachloromethane, silicon (IV) chloride, tin (IV) chloride and lead (IV) chloride are separately shaken with water. Write equations to illustrate your answer where necessary. (6marks)

c) i) Write an equation to show how lead (IV) chloride can be prepared in the laboratory. State the conditions for the reaction. (2marks)

ii) What type of bonding exists in lead (II) chloride? (1mark)

iii) State two physical properties which show that lead (II) chloride exhibits the type of bonding you have stated in c) ii). (2marks)

SECTION B. (40 marks)

Answer any two questions in this section.

5. a) Name one ore of zinc, and give its chemical formula. (2marks)
- b) (i) Describe briefly how the ore you have named in (a) is concentrated before the extraction of the metal. (3marks)
- (ii) What further treatment of the ore is required immediately after concentration. (2½marks)
- c) Outline the process, giving equations, for the production of zinc metal from the treated ore. (4½marks)

d) Zinc belongs to the d-block elements in the periodic table; yet it is not classified fully as a transition element. Explain this statement. (2marks)

e) Zinc chloride readily dissolves in water to form a solution with pH less than 7. Give reasons for this observation, and write an equation for the reaction that occurs. (3marks)

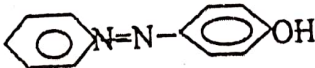
f) A piece of zinc metal was suspended in a solution of copper (II) sulphate in water. State what was observed and write an equation for the change that took place. (3marks)

6. Show how the following conversions could be carried out

a) Phenol to benzoic acid. (3½marks)

b) Propanoic acid to Ethanoic acid. (3marks)

c) Propyne to 2-methylpropane-2-ol. (3marks)

d) Benzene to  (4marks)

e) 2-bromopropane to propan-1-ol. (2½marks)

f) Benzoic acid to phenol. (4marks)

7. The table below shows the atomic radii of the alkaline earth metals.

Element	Atomic radius/nm	Ionic radius/nm
Beryllium	0.112	0.030

Magnesium	0.160	0.065
Calcium	0.197	0.094
Strontium	0.210	0.110
Barium	0.221	0.134

a) Using magnesium as an example, explain briefly what is meant by the term;

i) Atomic radius.

(2marks)

ii) Ionic radius.

(2marks)

b) Explain each of the following observations;

i) The ionic radius is, in each case, smaller than the atomic radius.

(2½marks)

ii) The atomic radius increases from beryllium to barium.

(2marks)

iii) The ions K^+ and Ca^{2+} have identical electronic configurations i.e. they are isoelectronic, yet the ionic radius of K^+ is larger than that of Ca^{2+} .

(1½marks)

c) i) Name one reagent that can be used to distinguish between magnesium ions and barium ions.

(1mark)

ii) State what would be observed in each case when the reagent in c) i) was used.

(1mark)

iii) Write equation(s) for the reaction(s) that take(s) place in ii).

(1½marks)

d) Beryllium differs from some of its properties from the rest of the alkaline earth metals.

i) State **three** properties in which beryllium differs from the rest of the alkaline earth metals.

(3marks)

ii) Explain why beryllium shows different properties from the rest of the alkaline earth metals.

(4marks)

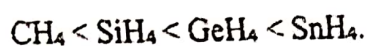
8. Explain each of the following observations.

a) The boiling point of 2-nitrophenol is lower than the boiling point of 4-nitrophenol. (3½marks)

b) The standard electrode potential of lithium is greater than that of potassium although potassium reacts more vigorously in water than lithium. (3marks)

c) Hydrogen fluoride is a much weaker acid than hydrogen chloride in aqueous solution. (3½marks)

d) The boiling points of the hydrides of group (IV) elements are in the order,



(2 marks)

e) Both cyclohexene and benzene decolorize bromine but only cyclohexene decolorizes potassium manganate (VII). (4 marks)

f) Calcium phosphate is more soluble in dilute hydrochloric acid than in water. (4marks)

END