

NAME..... INDEX NO.....

SCHOOL..... CANDIDATE'S SIGNATURE.....

DATE.....

233/2

CHEMISTRY

(THEORY)

PAPER 2

JULY/AUGUST 2014

TIME: 2 HOURS

KURIA WEST SUB-COUNTY JOINT EXAMINATION - 2014

Kenya Certificate of Secondary Education

CHEMISTRY

PAPER 2

(THEORY)

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

- Write your **name** and **index number** in the spaces provided **above**.
- **Sign** and write the **date** of examination in the spaces provided **above**.
- Answer **all** the questions in the spaces provided.
- Mathematics tables and electronic calculators may be used.
- All working **must** be clearly shown where necessary.

FOR EXAMINER'S USE ONLY:

Question	Maximum Score	Candidate's Score
1	12	
2	12	
3	12	
4	10	
5	11	
6	13	
7	10	
Total Score	80	

*This paper consists of 12 printed pages.
Candidates should check to ascertain that all the pages are printed
as indicated and that no questions are missing.*

1. (a) The table **below** shows the ions of elements **W**, **X**, **Y**, **Z** and their electron arrangement. The letters do not represent the actual symbols of the element.

Ion	Electron configuration
W^-	2, 8, 8
X^{2+}	2, 8, 8
Y^{3+}	2, 8
Z^2	2, 8

- (i) Which **two** elements belong to the same period? Give a reason. (2mks)

- (ii) In which group of the periodic table does Y belong? (1mk)

- (iii) Write the formula of the compound formed between **W** and **X**. (1mk)

- (iv) What type of bond is formed between **W** and **X**. Explain. (2mks)

- (b) (i) What is a coordinate bond. (1mk)

- (ii) Draw a dot (•) cross (X) diagram to show bonding in the hydroxonium. H_3O^+ ion (H = 1, O = 8). (2mks)

- (c) Aluminium chloride and sodium chloride are both chlorides of period 3 elements. Use this information to explain the following observations.

I A solution of AlCl_3 in water turns blue litmus paper red while that of sodium chloride does not. (1½mks)

II The melting point of sodium chloride (801°C) is higher than that of AlCl_3 (180°C). (1½mks)

2. (a) Use the standard electrode potentials for elements A, B, C, D and E given below to answer the questions that follow. The letters do not represent the actual symbols of the elements.

	E (volts)
$\text{A}_{(\text{aq})}^{2+} + 2e^- \rightleftharpoons \text{A}_{(\text{s})}$	-2.90
$\text{B}_{(\text{aq})}^{2+} + 2e^- \rightleftharpoons \text{B}_{(\text{s})}$	-2.38
$\text{C}_{(\text{aq})}^+ + e^- \rightleftharpoons \frac{1}{2}\text{C}_{2(\text{g})}$	0.00
$\text{D}_{(\text{aq})}^{2+} + 2e^- \rightleftharpoons \text{D}_{(\text{s})}$	+0.34
$\frac{1}{2}\text{E}_{(\text{aq})} + e^- \rightleftharpoons \text{E}^-$	+2.87

- (i) Which element is likely to be hydrogen? Give a reason for your answer. (2mks)

- (ii) Identify the strongest reducing agent. (1mk)

- (iii) In the space provided draw a labeled diagram of the electrochemical cell that would be obtained when half cells of element B and D are combined. (3mks)

- (iv) Calculate the E° value of the electrochemical cell constructed in (iii) above. (2mks)

- (b) During the electrolysis of copper (II) sulphate solution using copper electrodes, a current of 0.2A was passed through the cell for 5 hours.

(i) Write the equation of the reaction occurring at the anode. (1mk)

(ii) Determine the change in mass of the cathode which occurred as a result of the electrolysis process. (Cu = 64, IF = 96500C). (3mks)

3. (a) A hydrocarbon contains 85% carbon. Its molecular mass is 68g.

(i) Determine its empirical and molecular formula. (C = 12, H = 1). (2mks)

(ii) Draw two positional isomers of the hydrocarbon.

(1mk)

(iii) Write an equation for the reaction between one of the isomers with chlorine and name the products formed.
Equation. (2mks)

Name _____

(b) In an experiment an organic compound was reacted with absolute ethanol in the presence of concentrated sulphuric (VI) acid to form a compound whose formula is
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_3$

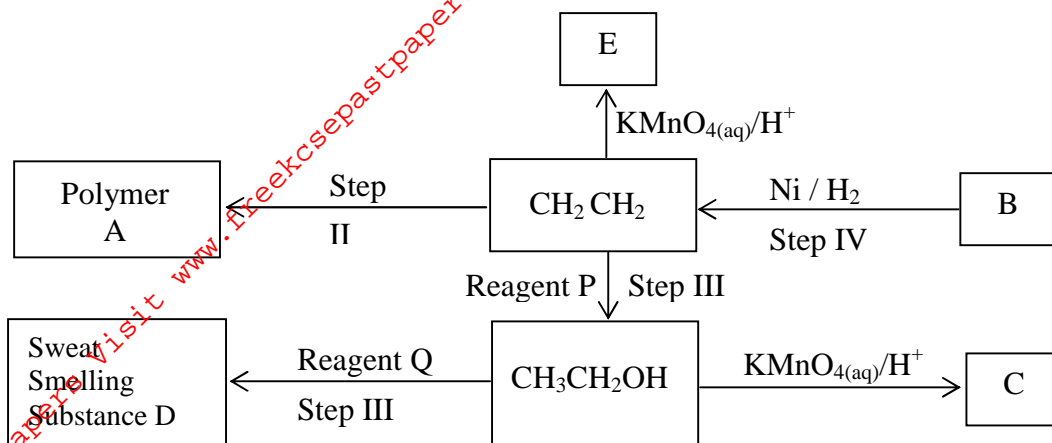
(i) Name I The type of reaction that took place. (½mk)

II The name of the organic compounds to which the compound belonged.

_____ (½mk)

(ii) Write the structural formula and give the systematic name of the acid used in the above experiment. (1mk)

(c) Study the flow diagram **below** and answer the questions that follow.



(i) Identify the following compounds.

B _____ (½mk)

C _____ (½mk)

A _____ (½mk)

E _____ (½mk)

(ii) Name the process in steps.

I _____ (½mk)

II _____ (½mk)

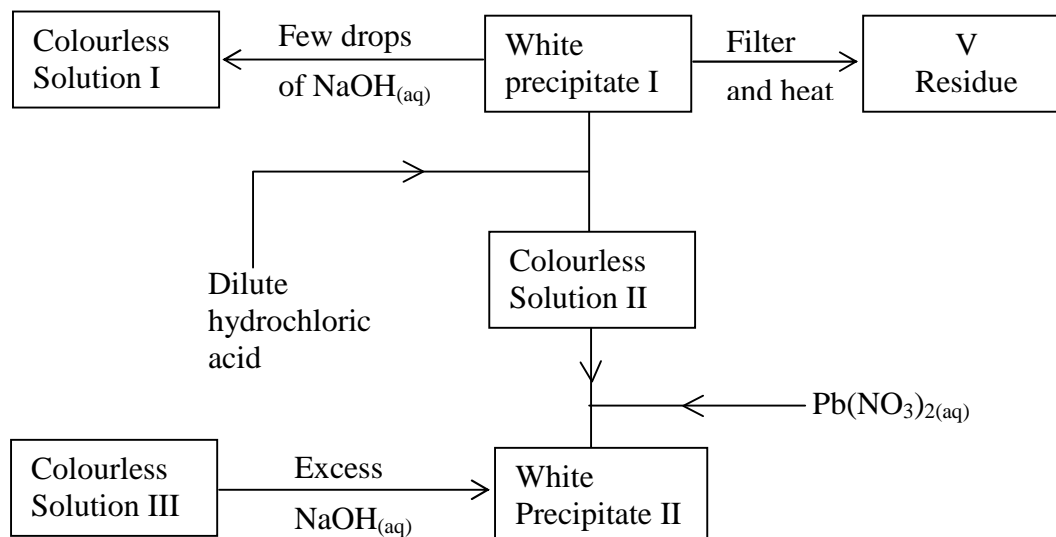
IV _____ (½mk)

(iii) Reagent

P _____ (½mk)

Q _____ (½mk)

4. (a) Study the flow chart **below** and answer the questions that follow.



Residue **V** was yellow when hot and white when cold.

(i) Identify

I White precipitate **I**

(1mk)

II Solution **II**.

(1mk)

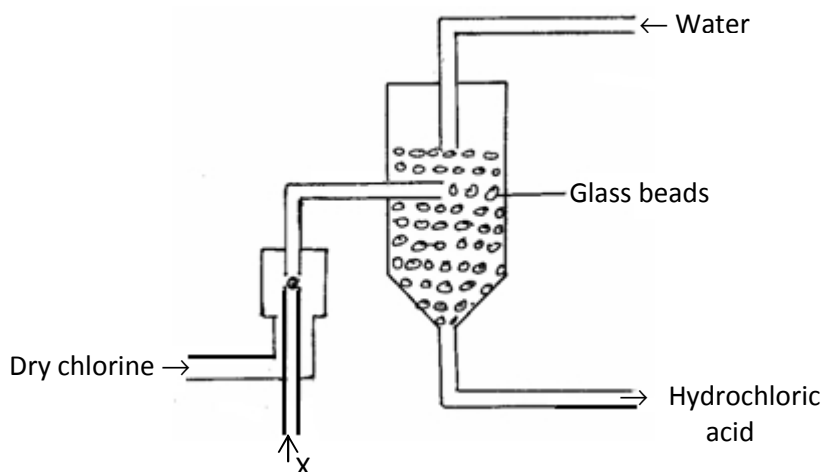
III Residue **V**.

(1mk)

(ii) Write an ionic equation for the reaction of solution **II** with $\text{Pb}(\text{NO}_3)_2(\text{aq})$. (1mk)

(iii) Write observations that would be made when ammonia solution is added drop wise till in excess to the colourless solution **II**. (1mk)

(b) The diagram **below** represents a set-up for large scale manufacture of hydrochloric acid. Study it and answer the questions that follow:



(i) Name substance **X**.

(1mk)

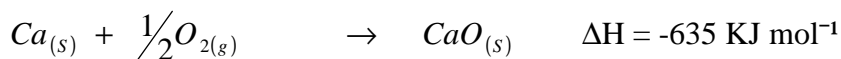
(ii) What is the purpose of glass beads?

(1mk)

(iii) Give **one** source of substance X used in the above process. (1mk)

(iv) Give **two** use of hydrochloric acid. (2mks)

5. (a) Use the information below to answer the questions that follow.



Calculate the enthalpy change for the reaction.



(b) State **one** factor that should be considered when choosing a fuel for cooking. (1mk)

(c) The following data was obtained during an experiment to determine the molar heat of combustion of ethanol.

Volume of water used	= 500cm ³
Initial temperature of water	= 25°C
Final temperature of water	= 44.5°C
Mass of ethanol + lamp before burning	= 121.5g
Mass of ethanol + lamp after burning	= 120.0g

Calculate the

- (i) heat evolved during the experiment (density of water = 1g/cm^3 , specific heat capacity of water = $4.2\text{Jg}^{-1}\text{K}^{-1}$). (1mk)

- (ii) molar heat of combustion of ethanol (C = 12, O = 16, H = 1). (2mks)

- (d) Write the thermo equation for the complete combustion of ethanol. (1mk)

- (e) At 298K and one atmosphere pressure, graphite changes into diamond according to the equation.



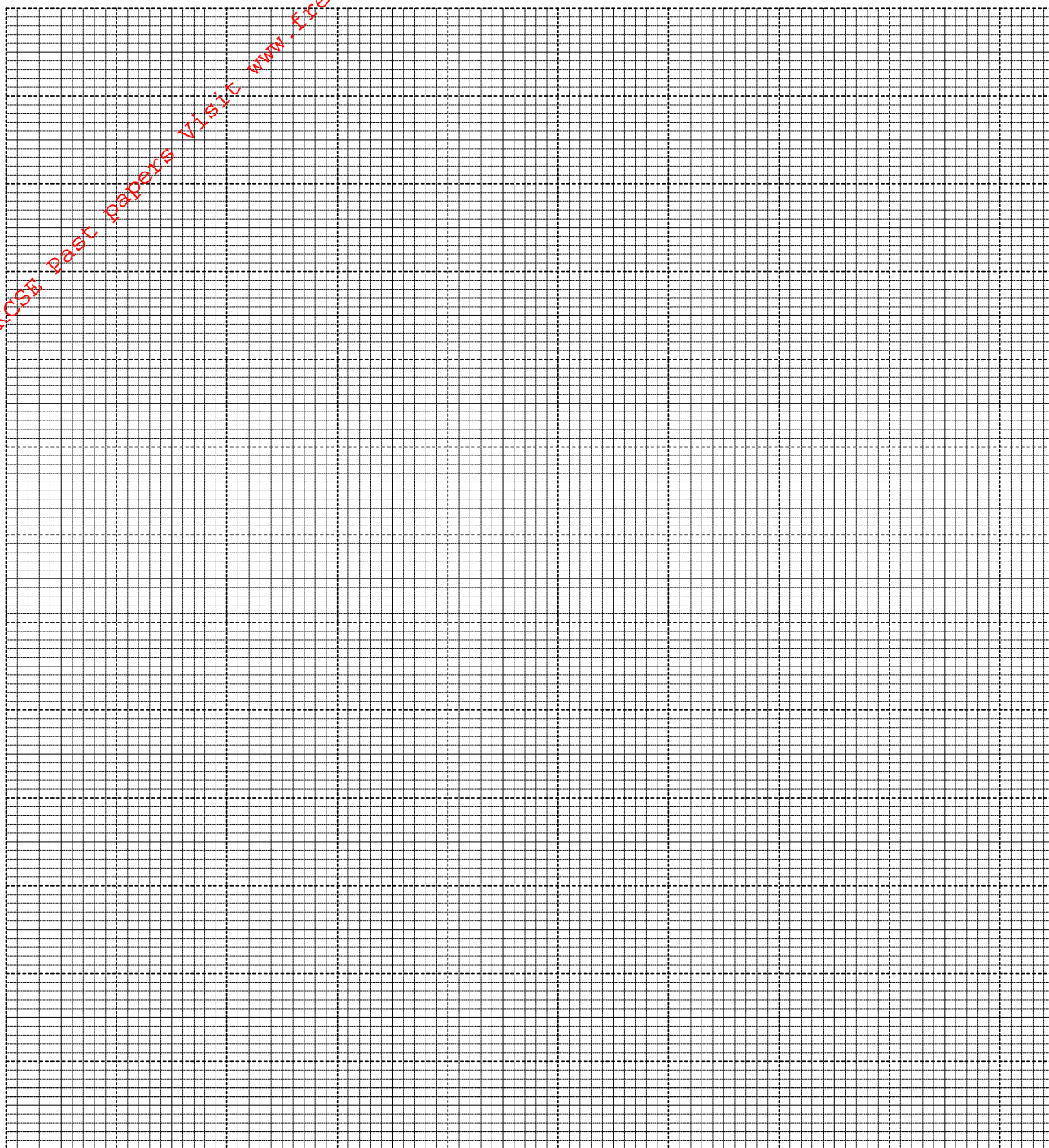
In the space provided, sketch a simple energy level diagram for the above change. (2mks)

6. (a) At 25°C 50g of substance X were added to 100g of water to make a saturated solution. What is meant a saturated solution? (1mk)

- (b) The table **below** gives the solubilities of substance X at different temperatures.

Temperature °C	14	24	33	40	46	52
Solubility g/100g H ₂ O	24	36	50	62	72	90

- (i) Plot a graph of the solubility of substance X (vertical axis) against temperature. (3mks)



- (ii) Using the graph.

I determine the solubility of substance X at 20°C.

(2mks)

- II determine the mass of substance X that remained undissolved given that 90g of substance X were added to 100cm³ of water and warmed to 35°C. (2mks)

- III Calculate the molarity of the solution at 30°C. (Relative formula mass of X = 122.5). (3mks)

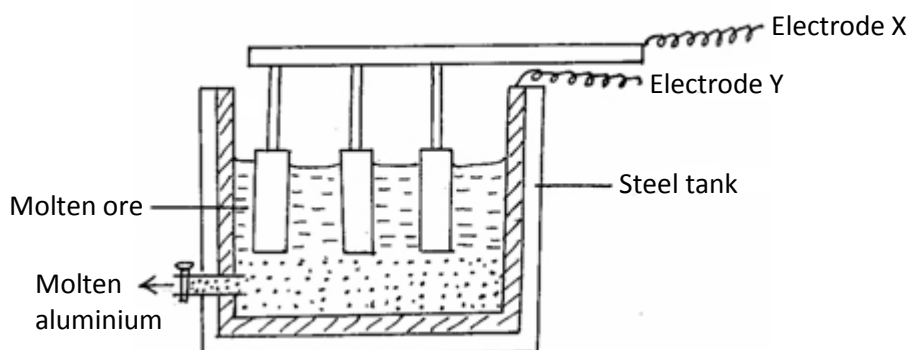
- (c) In an experiment, soap solution was added to three separate samples of water. The table **below** shows volumes of soap solution required to form lather with 1000cm³ of each sample of water before and after boiling.

	Sample		
Volume of soap before water is boiled (cm ³)	25.0	5.0	10.0
Volume of soap after water is boiled (cm ³)	25.0	5.0	5.0

- (i) Which water was likely to be soft? Explain. (2mks)

- (ii) Explain the change in volume of soap solution used in sample III. (1mk)

7. Aluminium is extracted using the electrolytic cell represented by the diagram **below**.



(a) Why is aluminium extracted by electrolytic method? (1mk)

(b) Name the electrodes labeled.

X _____ (½mk)

Y _____ (½mk)

(c) The chief ore from which aluminium is extracted is bauxite.

(i) Name **two** main impurities present in bauxite. (2mks)

(ii) Aluminium oxide is the main component in bauxite with a melting point of 2015°C but electrolysis of molten aluminium oxide is carried out at 800°C . Explain how this is achieved. (2mks)

(d) Write the equations for the reaction taking place at the anode. (1mk)

(e) One of the electrodes is replaced periodically. Which one and why? (2mks)

(f) Duralumin (an alloy of copper, aluminium and magnesium) is preferred to pure aluminium in the construction of aeroplane bodies. Give **one** property of duralumin that is considered. (1mk)
