NAME: …… INDEX NO: ……

SIGNATURE: …… DATE : ……

233/2
CHEMISTRY
PAPER 2
THEORY
JULY / AUGUST 2013
TIME: 2 HOURS

NANDI CENTRAL DISTRICT JOINT MOCK 2013

Kenya Certificate of Secondary Education (K.C.S.E.)
CHEMISTRY
PAPER 2
TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

- Write your Name and Index Number in the spaces provided above.
- Answer all the questions in the spaces provided after each question.
- Mathematical tables and non-programmable electronic calculators may be used.
- ALL working must be clearly shown where necessary.

FOR EXAMINER'S USE ONLY

QUESTIONS	MAX SCORE	CANDIDATE'S SCORE
1	14	
2	13	
3	13	
4	13	
5	09	
6	09	
7	09	
TOTAL	**80**	

1. The table below shows part of the Periodic table. The letter of the elements do not represent the actual symbols of the elements:-

X			Y					Z
U						W		

(i) How do the electrical conductivities of elements X and Y compare? Explain. (2mks)

(ii) Element W has two melting points. Explain this observation. (1mk)

(iii) When 1.15g of element U was reacted with cold water $0.6dm^3$ of hydrogen was produced at r.t.p. Calculate the relative atomic mas of U. (Molar gas volume = $24dm^s$ at r.t.p) (3mks)

(iv) Element V has atomic number 15. Show its position in the grid. (1mk)

(v) State **one** use of element Z. (1mk)

(vi) Oxide of element Y react with both acids and bases. What property is shown by element Y? (1mk)

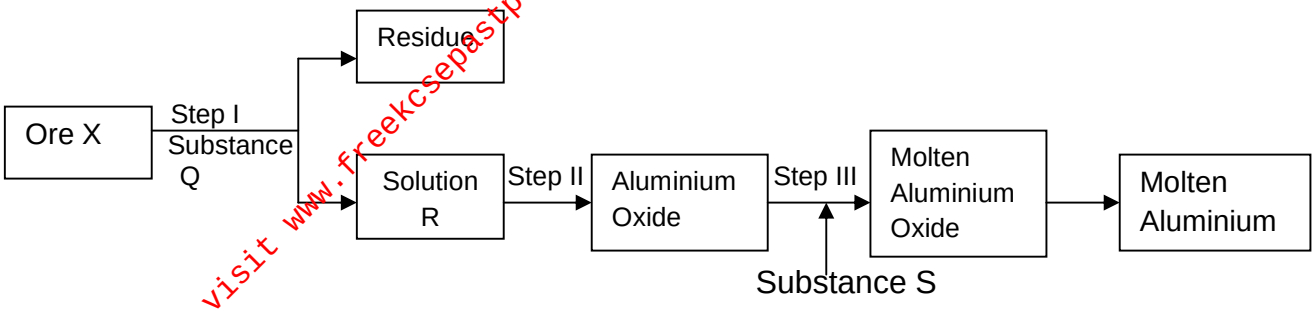
(vii) Explain (vi) above using chemical equations. (2mks)
(a)

(b)

(viii) Write down the equation for the reaction between element Y and Oxygen. (1mk)

(ix) Explain how the reactivity of elements X and U with chlorine compare. (2mks)

2. The process of extraction of Aluminium is summarized as below:



(a) (i) Write the formula of the main Ore X which is used in extraction of aluminium. (1mk)

(ii) Name:
(a) The main residue formed after filtration in step I. (1mk)

(b) Substance Q. (1mk)

(iii) How is the sodium Aluminate in Solution R separated from the impurity silicon (iv) oxide. (2mks)

(iv) What is the purpose of addition of substance S in step III. (2mks)

(b) (i) Explain why the Anode in extraction of Aluminium is replaced periodically. (2mks)

(ii) Write an equation for the formation of Aluminium at the cathode. (1mk)

(c) (i) Explain why Duralum an alloy of Aluminium is used in construction of aircraft parts and car window frames. (1mk)

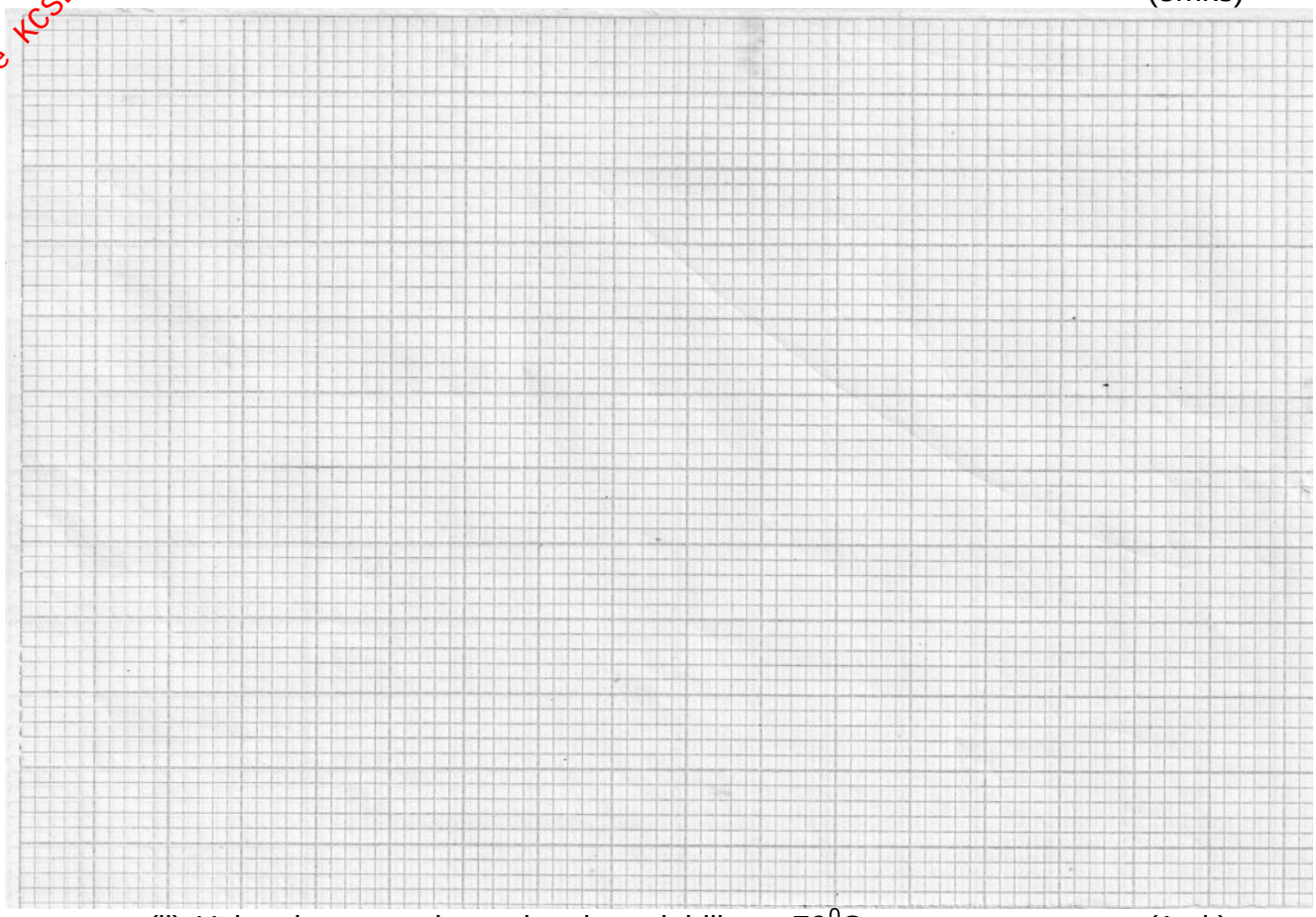
(ii) Apart from the application of Aluminium above, state two other uses. (2mks)

3. (a)(i) With the aid of a chemical equation, explain how boiling affects water hardness. (2mks)

(b) The saturated point of Sodium Nitrate in 100g of water is given for various temperatures in ^0C.

Temperature (^0C)	0	20	40	60	80	100
Saturation point (g/100g of H_2O)	73	88	104	124	148	180

(i) Plot a graph of saturation point of Sodium Nitrate against temperature. (3mks)

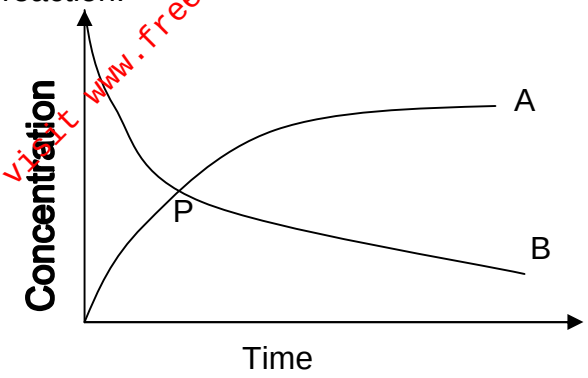


(ii) Using the curve determine the solubility at 70^0C. (1mk)

(iii) 100 grams of solution of sodium nitrate is in saturated conditions at 10^0C. How many grams of the salt will have to be added to make the solution just saturation at 80^0C. (2mks)

(iv) State **one** application of solubility. (1mk)

(II) The graph below is a plot of concentration against time for a given reaction.



a) What is represented by curve A? Explain. (2mks)

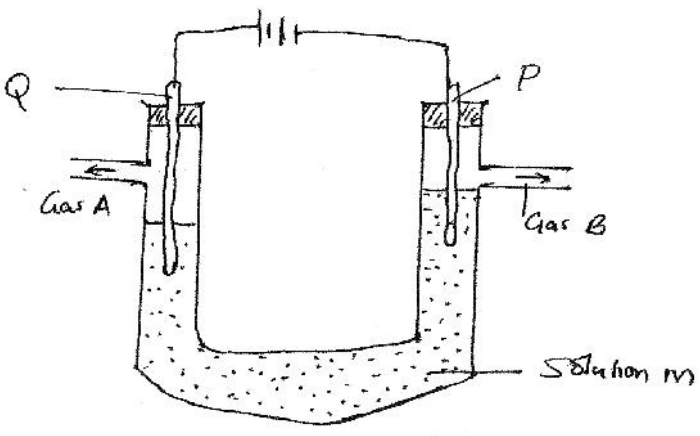
b) Explain why curve A rises fast then constant. (1mk)

c) What does point P represent on the graph? (1mk)

4. A tiny piece of potassium was burnt in air. A white residue was formed.
(a) Apart from the white residue state any other observation that was made. (1mk)

(b) Dilute Sulphuric (vi) acid was added to the white residue. A colourless solution M was formed.
(i) Write an equation that results in the formation of the colourless solution M. (1mk)

(ii) The solution M was electrolysed using graphite electrodes as shown in the set up below.



a) Identify **four** ions present in solution M. (2mks)

b) State the observation made at electrode P. Give a reason for your answer. (2mks)

c) Describe a simple test for gas A produced at electrode Q. (2mks)

d) Write the equation for the reaction taking place at electrode P. (1mk)

e) A current of 6A was passed through solution M for 27 minutes. Calculate the volume of gas A that was produced at room temperature and pressure. (Molar gas volume at r.t.p. = $24dm^3$, 1 Faraday = 96500 C). (3mks)

f) Compare the concentration of the electrolyte at the beginning of the experiment and at the end of the experiment. Explain. (2mks)

5. (I) The following account describes how crystals of a salt were made.
$30cm^3$ of sodium hydroxide solution was measured out and transferred into a conical flask. Dilute nitric (v) acid was then added, a little at a time until the solution was neutral. The volume of nitric (v) acid added was noted to be $28cm^3$. The solution was then evaporated until it was saturated. It was then left to cool to form crystals which later dried.

(a) What apparatus was used:

(i) to measure the $30cm^3$ of the sodium hydroxide solution? (1mk)

(ii) to add nitric (v) acid to the sodium hydroxide solution. (1mk)

(b) How would you determine if the solution is neutral? (1mk)

(c) Explain why crystals of the salt are formed when the saturated solution is cooled. (1mk)

(d) Write a chemical equation for the reaction. (1mk)

(e) Explain **one** of the salt prepared in this experiment. (1mk)

(II) At 35^{0}C the reaction between bromine and methanoic acid proceeds according to the equation below:

$$Br_{2(aq)} + HCOOH_{(aq)} \xrightarrow{H^+} 2Br^-(aq) + 2H^+_{(aq)} + CO_{2(g)}$$

The rate of reaction was determined by monitoring the time taken for bromine to be decolorized.

Concentration of bromine (mol dm^{-3})	Time taken
10.0×10^{-3}	0
8.1×10^{-3}	1
6.6×10^{-3}	2
4.4×10^{-3}	4
3.0×10^{-3}	6
2.0×10^{-3}	8
1.3×10^{-3}	10

(a) Plot a graph of bromine concentration (vertical axis) against time. (3mks)

(b) Using your graph,

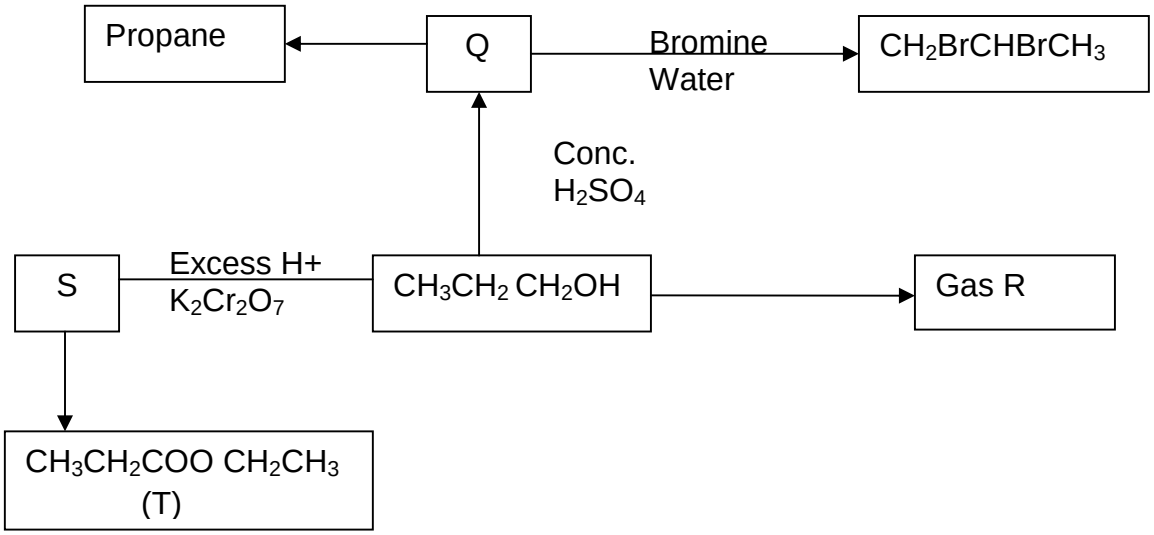
(i) State the concentration of bromine in the 3rd minute. (1mk)

(ii) Calculate the rate of reaction at 1½ minute. (2mks)

(c) Explain how the concentration of bromine affects reaction rate. (1mk)

(d) On the same axis, sketch the curve that would be obtained if the reaction was carried out at 20^0C and label it I. (1mk)

6. The scheme below shows several reactions starting with propanol. Study the scheme and answer the questions that follow.



(a) (i) Name gas R. (1mk)

(ii) Name and draw the structural formula of compound Q. (2mks)

(iii) What conditions and reagents are necessary to convert S to T? (2mks)

Reagent

Condition

(iv) Write an equation for the reaction that takes place when one mole of chlorine

gas react with propane. (1mk)

(b) The diagram below shows some properties of the organic compounds U, V and W. Use the information to answer the questions that follow.

	U	V	W
Reaction with liquid bromine	Decolourize bromine very fast	No reaction	Decolourizes bromine liquid slowly
Combustion	Burns with yellow smoky flame	Burns with a blue flame leaving no residue	Burns with a clear yellow flame
Reaction with conc. H_2SO_4	No reaction	It is dehydrated to form compound U	No reaction

(i) To which homologous series do the following compounds belong? (3mks)

U

V

W

7. (a) State the Hess's law. (1mk)

(b) The heat of combustion of propane, carbon and hydrogen are given below.

$C_3H_{8(g)} + 5O_{2(g)} \longrightarrow 3CO_{2(g)} + 4H_2O_{(l)}, \Delta H = 2220KJmol^{-1}$

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}, \quad \Delta H_2 = -393KJmol^{-1}$

$H_{2(g)} + \frac{1}{2} O_{2(g)} \longrightarrow H_2O_{(l)}, \quad \Delta H_3 = -285KJmol^{-1}$

(i) Using the information above, show the formation of propane using an energy cycle diagram. (2mks)

(ii) Calculate the heat of formation of propane. (2mks)

(iii) Write a thermochemical equation to show the formation of propane from its constituent elements. (1mk)

(c) Use the information below to answer the questions below:

Alkane	Heat of combustion (KJmol-1
Methane	8.9×10^2
Ethane	1.56×10^3
Propane	2.22×10^3
Butane	2.877×10^3
Pentane	3.534×10^3

(i) Predict the heat of combustion of hexane. (1mk)

(ii) Explain the difference in molar heat of combustion between the successive alkanes. (1mk)

(iii) Which of the alkanes will be the best fuel. Explain. (1mk)