NAME……..INDEX NUMBER……
CANDIDATES SIGNATURE……
DATE…….

233/3
CHEMISTRY
PAPER 3
(PRACTICAL)
JULY 2011
$2\frac{1}{4}$ HOURS
THIKA PROVINCIAL SCHOOL JOINT EXAMINATION

CHEMISTRY

PAPER 3
(PRACTICAL)

$2\frac{1}{4}$ HOURS

INSTRUCTIONS TO CANDIDATES

(a) Write your name and index number in the spaces provided above.
(b) Sign and write the date of examination in the spaces provided above.
(c) Answer all the questions in the spaces provided.
(d) Mathematical tables and electronic calculators may be used.
(e) All working must be shown clearly
(f) This paper consist of 8 printed pages.
(g) Candidates should check the questions paper to ascertain that all the pages are printed as indicated and that no questions are missing.

FOR EXAMINERS ONLY

QUESTIONS	**MAXIMUM SCORE**	**CANDIDATES SCORE**
1	19	
2	10	
3	11	
TOTAL SCORE	40	

1. You are provided with:
   - ❖ Solution A which is a mixture of sodium hydroxide and sodium carbonate.
   - ❖ Solution B which is 0.2M hydrochloric acid.

You are required to determine the percentage composition by mass of sodium carbonate in the mixture of the two compounds.

Procedure

Using a pipette and a pipette filler transfer 25cm^3 of solution A into a dry clean conical flask. Add 1 – 2 drops of phenolphthalein indicator. Place solution B in a burette and titrate solution A against solution B until the pink colour disappears. Record the final burette reading in table **I.** Add methyl orange to the contents of the conical flask you have just used. Record the burette reading as the initial reading in table **II.** Titrate against solution B to a **permanent red** end point. Record the final burette reading in table **II.** Repeat the procedure two more times in order to complete the tables **I** and **II.**

Table I

Experiment	**I**	**II**	**III**
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of acid B used in cm^3 (V_1)			

(4mks)

Table II

Experiment	**I**	**II**	**III**
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of acid B used in cm^3 (V_2)			

(4mks)

N.B The reactions between this mixture of alkali and sodium carbonate can be expressed using the following equations.

$NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$

$Na_2CO_{3(aq)} + HCl_{(aq)} \longrightarrow NaHCO_{3(aq)} + NaCl_{(aq)}$

$NaHCO_{3(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$

(a) Calculate the:

(i) Average titre for the two tables. (2mks)

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(ii) Total volume of acid B that reacts with the sodium carbonate. Hint: one mole of sodium hydrogen carbonate is formed from one mole of sodium carbonate. Hence volume of the acid required to react with the carbonate completely = $2V_2$. ($^1/_2$mk)

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(iii) Volume of acid B that reacts with sodium hydroxide only.
Hint = $(V_1 + V_2)- 2V_2$. ($^1/_2$mk)

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(b) Calculate the number of moles of:

(i) Hydrochloric acid (solution B) that reacts with all the sodium hydroxide in solution A.(1mk)

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(ii) Hydrochloric acid (solution B) that reacts with all the sodium carbonate in the solution.(1mk)

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(c) Use your answers in (b)(i) and (ii) above to calculate the number of moles of:

(i) Sodium hydroxide in $25cm^3$ of the mixture. (1mk)

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(ii) Sodium carbonate in 25cm^3 of the mixture. (1mk)

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(d) Calculate:

(i) The mass of the alkali per litre of the solution. ($1^1/_2$mk)
(Na = 23.0 O = 16.0 H = 1.0)

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(ii) The mass of the Sodium carbonate per litre of the solution. ($1^1/_2$mk)
(C = 12.0)

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(iii) Hence calculate the percentage of sodium carbonate in the mixture. (1mk)

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2.You are provided with:

Hydrogen peroxide, solution Q
Potassium iodide, solution R
Sodium thiosulphate, Solution S
Dilute Sulphuric (vi) acid, solution T
Starch; solution U
Distilled water in a wash bottle.

You are required to determine how the rate of reaction of hydrogen peroxide with potassium iodide varies with the concentration of hydrogen peroxide.

Procedure.

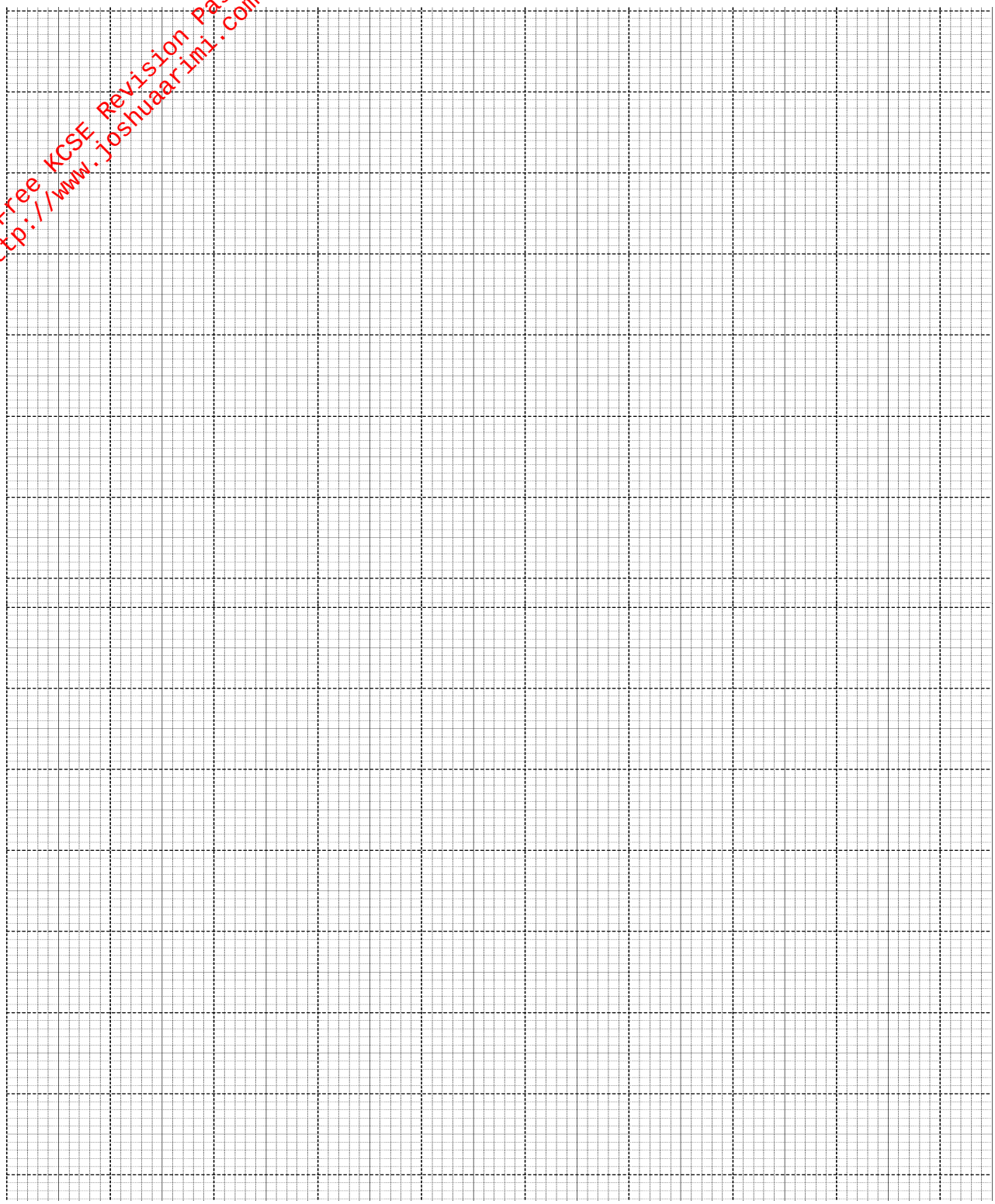
Label two 100ml beakers X and Y. Using a clean burette place 30.0cm^3 of solution Q into beaker X. Using a 10ml measuring cylinder place 5.0cm^3 of solution R into beaker Y, followed by 5.0cm^3 of solution S, 5.0cm^3 of solution T then 2.0cm^3 of solution U and shake the contents. Pour the contents of beaker X into beaker Y and immediately start the stop watch / clock. Note the time taken for the blue colour to appear. Record the time in the space provided in the table below. Clean beaker Y and repeat the procedure with the volume of water, solutions Q, R, S, T and U as shown in the table below for experiments 2 to 5.

(a) Complete the table by completing the reciprocal of time. (1/t) (5mks)

Table III

Experiment	1	2	3	4	5
Volume of hydrogen peroxide	30	25	20	15	10
Volume of water	0	5	10	15	20
Volume of potassium iodide	5	5	5	5	5
Volume of sodium thiosulphate	5	5	5	5	5
Volume of 2M sulphuric acid	5	5	5	5	5
Volume of starch solution	2	2	2	2	2
Time in seconds					
Reciprocal of time Sec $^{-1}$ to 4 s.f					

(b) Plot a graph of $^1/t$ (vertical axis) against volume of hydrogen peroxide used. (3mks)



(c) From your graph determine the time the reaction would take if the volume of hydrogen peroxide used is 18.0 cm^3. (1mk)

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(d) How does the concentration of hydrogen peroxide affect its rate of reaction with potassium iodide. (1mk)

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3. You are provided with solid M, which is a mixture of two compounds. Carry out the tests below and write your observations and inferences in the spaces provided.

(a) Place all of solid M in a clean boiling tube. Add about $25cm^3$ of distilled water, shake well and filter the mixture. Wash the residue by adding some distilled water. Keep both filtrate and the residue.

Observation	**Inference**

(1mk) (½ mk)

(b) Divide the filtrate into three portions.

(i) Add lead (II) nitrate to the first portion followed by dilute nitric acid.

Observation	**Inference**

($^1/_2$mk) (1mk)

(ii) Add about $2cm^3$ of 2M sodium hydroxide to the second portion and warm the mixture. Test the gas produced using litmus paper.

Observation	Inference

(1mk) ($^1/_2$mk)

(c) Scrape the solid residue from the filter paper in step (a) and transfer it into the boiling tube.

(i) Add about $10cm^3$ of dilute nitric (V) acid.

Observation	Inference

(1mk) (1mk)

(ii) Divide the solution in (i) above into three portions.

(a) To the first portion, add sodium hydroxide drop wise until in excess.

Observation	Inference

(1mk) (1mk)

(b) Add ammonia solution to the second portion drop wise until in excess.

Observation	Inference

(1mk) ($^1/_2$mk)

(c) Add a few drops of dilute hydrochloric acid to the third portion. Warm the mixture and allow to cool.

Observation	Inference

(1mk) (1/2mk)