NAME…… **INDEX NO**……

SCHOOL…… **SIGN**……

DATE……

Kenya Certificate of Secondary Education (K.C.S.E)

233/3

CHEMISTRY

Paper 3

PRACTICAL

Time: 2 ¼ Hours

INSTRUCTIONS TO CANDIDATES.

- *Answer **all** the questions in the spaces provided*
- *You are **not** allowed to start working with the apparatus for the first 15 minutes of the 2 ¼ hours allowed in this paper. This is to enable you read the question paper and make sure you have all the chemicals and apparatus you may need.*
- *Mathematical tables and Electronic calculators may be used.*
- *All working **must** be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

Question	Maximum Score	Candidates Score
1	20	
2	12	
3	8	
Total	40	

QUESTIONS

1. **You are provided with:**

- Solution **B** containing **19.2g** of anhydrous sodium carbonate per litre of solution,
- Solution **C_1** , hydrochloric acid,
- Two portions of sodium hydrogen carbonate, solid **D**, each 2.5g.
- Methyl orange indicator

Yor are required to:

- Prepare a dilute solution of hydrochloric acid, solution **C2**
- Determine the molarity of concentrated HCl solution **C1**.
- Determine the molar heat of reaction of hydrochloric acid and aqueous sodium hydrogen carbonate.

Procedure 1

Using a 100ml measuring cylinder, place 50cm^3 of solution **C_1** into a 250ml volumetric flask. Add inside distilled water upto the mark. Label this as solution **C_2**. Fill the burette with solution B. Pipette 25.0cm^3 of solution **C_2** and place it in a conical flask. Add inside three drops of methyl orange indicator provided and titrate with solution B from the burette. Record your results in table 1 below. Repeat the titrations two more time and complete table 1 below.

Table 1

	I	II	III
Final burette reading			
Initial burette reading			
Volume used			

(3 marks)

a) Calculate the:
   (i) Average volume of solution B used. (1 mark)

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(ii) Concentration of solution B in moles per litre. (Na = 23, C= 12, O =16) (1 mark)

(iii) Moles of sodium carbonate, solution B in the average volume used (1 mark)

(iv) Moles of hydrochloric acid solution C_2 in $25cm^3$ of solution (1 mark)

(v) Moles of hydrochloric acid solution C_2 in $250cm^3$ of solution (1 mark)

(vi) Concentration of original hydrochloric acid, solution C_1. (2 marks)

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2) You are provided with **solid M**. Carry out the tests below and write your observations and inferences in the spaces provided.

a) Place about one third of solid **solid M** on a clean metallic spatula and ignite it using a Bunsen burner flame.

Observation	Inference
1 mark	**1 mark**

(b) Place the remaining solid **M** in a clean dry test tube, add inside about 10 cm^3 of distilled water and shake well.

Observation	Inference
1 mark	**1 mark**

(c) Use 2cm^3 portions of the mixture obtained in (b) above for the tests below.

(i) To the 1st portion add inside 3 drops of bromine water

Observation	Inference
1 mark	**1 mark**

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(ii) To the 2nd portion add inside 1cm^3 of acidified potassium dichromate (VI) and warm the mixture.

Observation	Inference
1 mark	**1 mark**

(iii) To the 3rd portion add inside the whole of sodium hydrogen carbonate provided. Test any gas produced with burning wooden splint.

Observation	Inference
1 mark	**1 mark**

3) You are provided with solution **N** which is a mixture of two salts**.** Carry out the tests below and write your observations and inferences in the spaces provided. Use 2cm^3 portions for each of the tests described below.

a) To the 1st portion add aqueous sodium hydroxide drop wise until in excess.

Observation	Inference
1 mark	**1 mark**

b) To the 2nd portion, add inside aqueous ammonia drop wise until in excess

Observation	Inference
1 mark	**1 mark**

c) To the 3rd portion add inside 5 drops of dilute nitric (V) acid.

Observation	Inference
1 mark	**1 mark**

d) To the 4th portion add inside 5 drops of aqueous barium nitrate.

Observation	Inference
1 mark	**1mark**

e) To the 5th portion add inside a piece of aluminium foil followed by 3 drops of sodium hydroxide and heat the mixture to boiling. Test the gas produced with red litmus paper.

Observation	Inference
1 mark	**1 mark**

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QUESTIONS

2. You are required to:

Determine the concentration of sodium hydroxide in moles per liter.

Determine the molar heat of neutralization of hydrochloric acid with sodium hydroxide

Procedure 1.

(i) Using a burette, place 5.0cm^3 of solution **C** in 6 test tubes.

(ii) Using a clean 100ml measuring cylinder, place 50.0cm^3 of solution **B** into a 100ml plastic beaker.

(iii) To solution **B** in the beaker, add hydrochloric acid, solution **C** from one of the test-tubes. Stir the mixture with the thermometer and record it in table 2, the maximum temperature reached. Continue with step (iv) **IMMEDIATELY.**

(iv) Add the hydrochloric acid, solution **C** from another test-tube to the mixture obtained in (iii) above, stir and record the maximum temperature reached in table 2. Continue adding the hydrochloric acid, solution **C** from each of the other four test-tubes, stirring the mixture and recording the maximum temperature each time and complete table 2.

Table 2

Volume of solution **C**(cm^3)	0.0	5.0	10.0	15.0	20.0	25.0	30.0
Temperature (^oC)							

(a) Plot a graph of temperature against volume of solution C added. (3 marks)

(b) From the graph determine:

(i) The volume of solution **C** that reacted completely with 50.0cm3 of solution B. (1mark)

(ii) The change in temperature. (1 mark)

(c) Calculate the:

(i) Concentration of solution **B** in moles per litre. (Na= 23,O= 16, H=1)

(ii) Moles of solution **B** used. (1mark)

(iii) Moles of **C** used(1mark)

(iv) Concentration of **C** in moles per liter. (1mark)

(d) Calculate the molar heat of neutralization of solution of solution **C** with solution **B (1mark)**

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