

NAKURU DISTRICT SEC. SCHOOLS
TRIAL EXAMINATION 2014
Kenya Certificate of Secondary Education (K.C.S.E.)

233/3

CHEMISTRY PRACTICAL

Paper 3

July/August 2014

CONFIDENTIAL

INSTRUCTIONS TO SCHOOLS

The information contained in this paper is to enable the heads of the school and the teacher in charge of chemistry to make adequate preparations for this year's chemistry practical joint examination. **NO ONE ELSE** should have access to this paper or acquire knowledge of its contents. Great care **must** be taken to ensure that the information herein does not reach the candidates either directly or indirectly. Chemistry teachers **SHOULD NOT** perform any of the experiments in the same room as the candidates or make the results of the experiments available to the candidates or give any other information related to the experiments. Doing so will constitute an examination irregularity which is punishable.

CHEMISTRY PAPER 3

CONFIDENTIAL INSTRUCTIONS

Instructions to schools

The teacher in charge of chemistry is expected to do the experiment and fill in table I and II as in the candidate's question paper and note the results as the school values.

Requirements

In addition to the equipment, apparatus and chemicals in an ordinary chemistry laboratory, each candidate requires the following:-

- Means of labeling
- 5 g Solid **A**
- 100 ml solution **B**
- 40 ml solution **C**
- 70 ml solution **D**
- 1 g solid **E**
- 1 g solid **F**
- Metallic spatula
- Six dry test tubes
- boiling tube
- Burette
- Pipette
- Pipette filler
- Methyl orange indicator
- 100ml measuring cylinder
- 250 ml volumetric flask
- distilled water in a wash bottle
- 1 g sodium hydrogen carbonate

Access to:-

- Bunsen burner
 - Acidified potassium manganate (VII)
 - Bromine water
 - 2 M sodium hydroxide
 - 1 M barium nitrate
 - 2 M nitric V acid
 - Acidified potassium dichromate (VI)
- (solutions supplied with a dropper)

Notes:

Solid **A** is a mixture of anhydrous sodium carbonate and sodium chloride in the ratio 7:3 (weighed accurately)

- Solution **B** is 0.2 M HCl
- solution **C** is 2 M Sodium hydroxide
- Solution **D** is 2 M HCl
- Solid **E** is ascorbic acid
- Solid **F** is sodium sulphite

NAME:.....

INDEX NO:.....

SIGNATURE.....

DATE.....

233/3

CHEMISTRY

PRACTICAL

Paper 3

JULY/AUGUST 2014

TIME: 2¼ HOURS

NAKURU DISTRICT SECONDARY SCHOOLS TRIAL EXAMINATION- 2014

Kenya Certificate of Secondary Education

CHEMISTRY

Paper 3

PRACTICAL

2¼ HOURS

Instruction to Candidates

1. Write your name and index number in the spaces provide above
2. Answer **ALL** questions in the spaces provided in the question paper
3. Sign and write date of examination in the spaces provided.
4. You are **NOT** allowed to start working with the apparatus for the first **15** minutes of the 2¼ hours allowed for this paper. This time is to enable you to read the question paper and make sure you have all the chemicals and apparatus that you may need.
5. Mathematical tables and electronic calculators may be used
6. All working **MUST** be shown where necessary.

For Examiners use only

Question	Max. Score	Score
1	12	
2	13	
3	15	
Total score	40	

This paper consist of 8 printed pages

Candidate should check the question paper to ensure that all the papers are printed as indicated and no questions are missing.

1. You are provided with

- 10g of solid **A** which is a mixture of sodium carbonate and sodium chloride.
- 0.2 M HCl solution **B**

You are required to

- Determine the concentration of sodium carbonate in the mixture.
- Percentage of sodium chloride in the mixture.

Procedure

Transfer the entire solid into a 250 ml volumetric flask. Add about 100cm³ of distilled water. Shake to dissolve. Top up with more distilled water to make up to the mark. Label this solution **A2**. Using a pipette and a pipette filler, transfer 25 cm³ of this solution into a conical flask. Repeat the procedure two more times to complete table 1

Table 1

	I	II	III
final burette reading (cm ³)			
initial burette reading (cm ³)			
volume of solution B used (cm ³)			

(a) Calculate

(i) The average volume of solution **B** used (1mark)

.....

.....

.....

(ii) The number of moles of HCl in the average titre (1 mark)

.....

.....

.....

(b) Write an equation for the reaction (1mark)

.....

.....

(c) calculate the number of

(i) Moles of sodium carbonate in 25cm³ of solution **A2** (1 mark)

.....

.....

.....

(ii) The moles of sodium carbonate in 250 cm³ of solution A2 (1 mark)

.....
.....
.....

(d) Determine the mass of sodium carbonate in solid A (1 mark)
(Na=23, C = 12.0, H=1.0 , O= 16)

.....
.....
.....

(e) Calculate the percentage of sodium chloride in solid A (1 mark)

.....
.....
.....

2. You are provided with

- Solution **D**, 2M HCl
- Solution **C** 2 M NaOH

You are required to determine the heat of neutralization

Procedure

Wrap a plastic beaker with tissue paper and secure it with a rubber band.

Use a measuring cylinder to transfer 20cm³ of solution C into a plastic beaker.

Take its initial temperature and record it in table 2 below.

Using a clean measuring cylinder, measure 5 cm³ of solution **B** and add it to solution **C**. Stir the mixture immediately with a thermometer and record the highest temperature in table 2

Continue adding 5 cm³ portions of solution every time record the highest temperature attained to complete the table

Table 2

Volume of D add cm ³	0	5	10	15	20	25	30
Volume of A+D cm ³	20	25	30	35	40	45	50
Temperature of mixture °C							

(4 marks)

Plot a graph of volume of solution **D** (X-axis) against highest temperature (3 marks)

(a) From the graph:

(i) Determine the volume of solution **D** that reacts completely with solution **C**. (1 mark)

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.....
.....

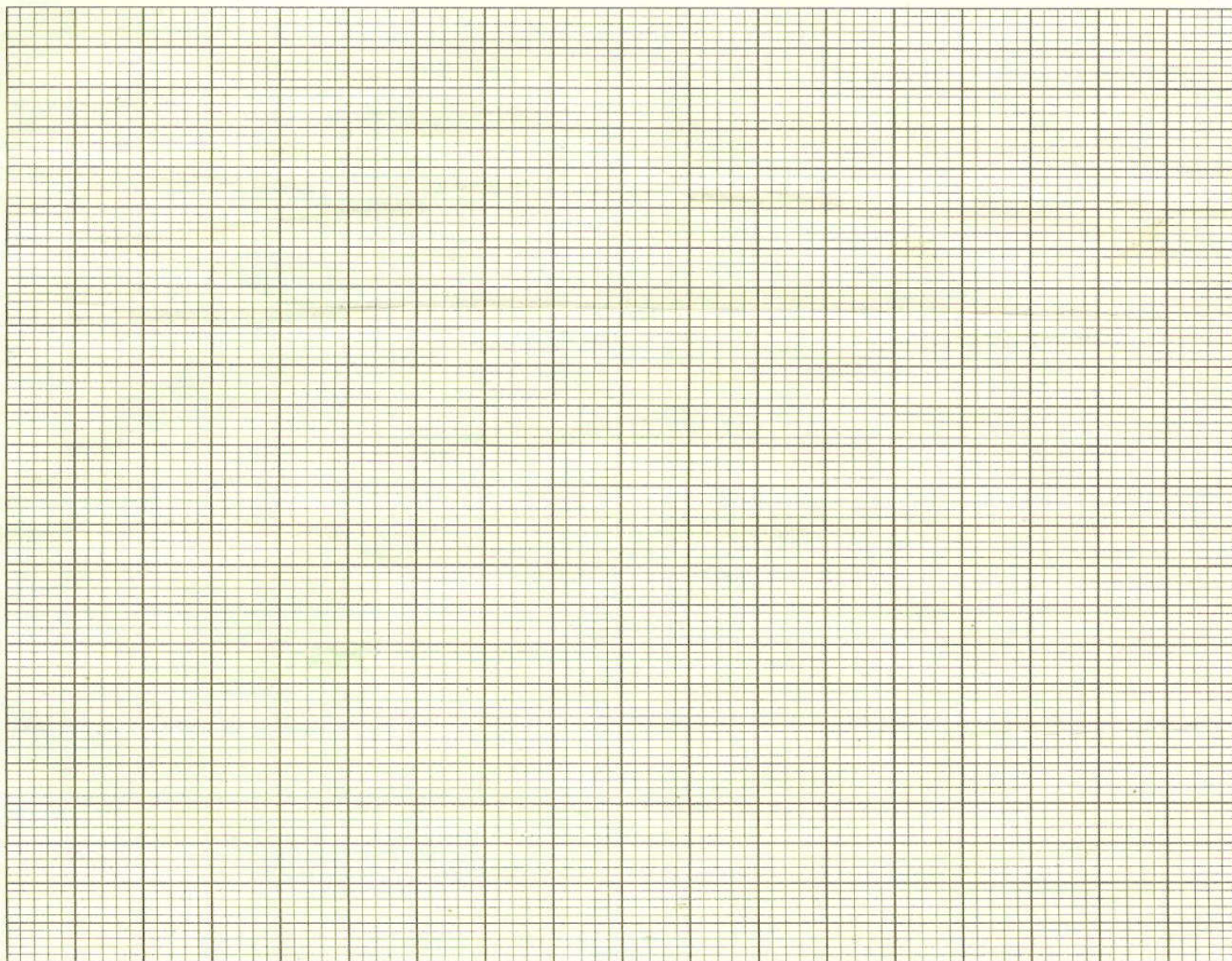
(ii) The highest temperature change ΔT

(1 mark)

.....

.....

.....



(b) (i) Calculate the amount of heat evolved by the reaction (assume specific heat of capacity = $4.2 \text{ J g}^{-1} \text{ K}^{-1}$, density of solution = 1 g/cm^3) (1 mark)

.....

.....

.....

(ii) Calculate the number of moles of HCl used

(1 mark)

.....
.....
.....

(iii) Calculate the molar heat of neutralization of HCl

2 marks)

.....
.....
.....

3. (a) You are provided with solid E. Carry out the following tests and write your observations and inferences in the spaces provided.

(i) Place one third of solid E on a metallic spatula and ignite using a Bunsen burner flame

observation	Inferences
(1 mark)	(1 mark)

(ii) Place all the remaining solid in a boiling tube. Add 5cm³ of distilled water. Shake to dissolve and divide it into 4 portions

(I) to the first portion add three drops of acidified potassium manganate (VII)

observation	Inferences
(1 mark)	(1 mark)

(II) To the second add three drops bromine water.

observation	Inferences
(1 mark)	(1 mark)

(III) To the third portion add all the sodium hydrogen carbonate provided

observation	Inferences
(1 mark)	(1 mark)

(b) You are provided with solid **F**. Carry out the tests below and record your observations and inferences in the spaces provided. Place all the solid **F** in a boiling tube. Add 10cm³ of distilled water. Divide into four portions.

observation	Inferences
(½ mark)	(½ mark)

(i) To the first portion, add aqueous hydroxide drop wise until in excess.

observation	Inferences
(1 mark)	(1 mark)

(ii) To the second portion add 5 drops of barium nitrate solution, followed by 3 drops of dilute nitric acid.

observation	Inferences
(1 mark)	(1 mark)

(iii) To the third portion add 3 drops of acidified sodium dichromate (VI) solution

observation	Inferences
(1 mark)	(1 mark)

NAKURU DISTRICT SEC. SCHOOLS TRIAL EXAMINATIONS

-2014

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

MARKING SCHEME 233/3 CHEMISTRY PAPER 3

1. Table 1..... (5 marks)

Distributed as follows:

A. Complete table..... (1 mark)

Conditions:-

i) Complete table with 3 titrations done (1 mark)

ii) incomplete table with 2 titrations done (½ mark)

iii) incomplete table with 1 titration done (0 mark)

Penalties

i) wrong arithmetic/subtraction

ii) inverted table

iii) burette reading >50 unless explained (50+)

iv) unrealistic values i.e values less than 1cm^3 or in hundreds

NB: penalize ½ mark once for one for all

B Use of decimals (tied to the 1st and 2nd row only..... (1 mark)

i) Accept 1 or 2 decimal places used consistently otherwise penalize fully

ii) If 2 decimal places are used the 2nd must be a 0 or a 5 otherwise penalize fully

iii) Accept inconsistency in the use of zero's e.g. 0, 0.0, and 0.00

C Accuracy..... (1 mark)

Compare the candidate's correct titre with the teacher's value

Conditions:-

i) If at least one titre value is within ± 0.1 of teachers value award (1 mark)

ii) If no value is within ± 0.1 of the teacher's value but there is one within ± 0.2 award (½ mark)

iii) If no value within ± 0.2 award.....(0 mark)

NB: where the candidate has wrong arithmetic use the correct worked out value to award.

D. Principles of averaging..... (1 mark)

Values to be averaged must be within ± 0.2 of one another

i) If three consistent titres are done and averaged (1 mark)

ii) If three titrations are done but only two are consistent and are averaged (1 mark)

iii) If only two consistent titrations are done and averaged (1 mark)

iv) If three inconsistent done and averaged (0 mark)

v) If three consistent titrations done, two averaged (0 mark)

vi) If two inconsistent done and averaged (0 mark)

Penalties

Penalize ½ mark for

i) No working if answer is correct

ii) Rounding off to 1 decimal place (unless it works out to 1 decimal place or to whole number)

- E Final accuracy (1 mark)
 Compare the candidate's correct average titre with the teacher's value
 i) If within ± 0.1 (1 mark)
 ii) If within ± 0.2 ($\frac{1}{2}$ mark)
 iii) If not within ± 0.2 (0 mark)
 NB: where there are two possible average values use the value giving maximum credit

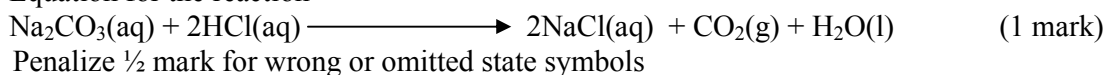
Calculations

ii) Moles HCl

$$\frac{0.2 \times \text{titre} \checkmark \frac{1}{2}}{1000} = \text{correct ans. accept answer to at least 4 decimal places (Unless it (1 mark) works out otherwise) } \checkmark \frac{1}{2}$$

- ignore units, but if given must be correct
- Penalize wrong transfer of titre value

(b) Equation for the reaction



(c) (i) Moles Na_2CO_3 in 25 cm^3
 $0.5 \times \text{answer (a)(ii)} \checkmark \frac{1}{2} = \text{correct answer} \checkmark \frac{1}{2}$ (1 mark)

(ii) Moles Na_2CO_3 in 250 cm^3
 $\frac{25 \times \text{answer c(i)} \checkmark \frac{1}{2}}{250} = \text{correct answer} \checkmark \frac{1}{2}$ (1 mark)

(d) Mass of sodium carbonate in solid A
 $106 \times \text{answer c(ii) above} \checkmark \frac{1}{2} = \text{correct answer} \checkmark \frac{1}{2}$ **correct units** (1 mark)

(e) Percentage of sodium chloride
 $\frac{(10 - \text{answer d above}) \checkmark \frac{1}{2}}{10} \times 100 = \text{correct answer} \checkmark \frac{1}{2}$ (1 mark)
 Penalize for answer if above 40% or below 20%

- 2 Table 2(4 marks)
 A. Complete table(1 mark)
 6-7 entries (1 mark)
 4-5 entries ($\frac{1}{2}$ mark)
 B. Decimal place – accept whole numbers or 1 decimal place, which must be a zero or a five
 C. Accuracy - compare with teachers value, $\pm 2^\circ$ (1 mark)
 D. Trend – continuous rise $\frac{1}{2}$ mark followed by a fall $\frac{1}{2}$ mark (1 mark)

Graph (3 marks)

- Labelling of axes $\frac{1}{2}$ mark
 - scale $\frac{1}{2}$ mark- more than
 - Plots 1 mark $\frac{1}{2}$ of grid
 - shape 1 mark
- } 3 marks

(a)(i) Volume of solution D } 1 mark
 - showing ½ mark
 - correct reading ½ mark

(ii) ΔT 1 mark)
 - Showing on correct extrapolated graph ½ mark
 - Correct reading ½ mark

(b) (i) $MCA\Delta T$ (1 mark)
 -correct substitution ½ mark
 - correct answer ½ mark

(ii) Moles HCl
 $\frac{\text{volume in a(i)}}{1000} \times 2 M \checkmark \frac{1}{2} = \text{correct answer} \checkmark \frac{1}{2} \text{ mark}$

(iii) Molar heat of neutralization Hcl.....(2 marks)

Ans b(i) ✓1

Ans b(ii)

✓1

$\Delta H =$ - correct answer kJ mol^{-1}

Penalize – ½ mark if –ve sign is missing

- ½ mark if units missing or wrong

3. (a) You are provided with solid E. Carry out the following tests and write your observations and inferences in the spaces provided.

(i) Place one third of solid E on a metallic spatula and ignite using a Bunsen burner flame

observation	Inferences
Burns with a yellow sooty /smoky flame	Long chain hydrocarbon or unsaturated organic compound, or compound with a high carbon hydrogen ratio Or $\text{>C}=\text{c}<$ $-\text{c}\equiv\text{c}-$ Reject – long chain hydrocarbon
(1 mark)	(1 mark)

(ii) Place all the remaining solid in a boiling tube. Add 5cm^3 of distilled water. Shake to dissolve and divide it into 4 portions

(I) to the first portion three drops of acidified potassium manganate (VII)

Observation	Inferences
KMnO_4 decolourised	R – OH
Accept	$\begin{array}{c} \quad \\ \text{C}=\text{c} \\ \quad \end{array}$ or $-\text{C}\equiv\text{c}-$ present
Potassium Manganate (VII) turns from purple to colourless	
1 mark	1 mark

(II) To the second a three drops bromine water.

Observation	Inferences
Bromine water decolourised ✓1 (Accept Orange/yellow/red bromine turns colourless) (1 mark)	$\begin{array}{c} \diagdown \quad \diagup \\ \text{C} = \text{C} \\ \diagup \quad \diagdown \end{array}$ Or $-\text{C} \equiv \text{c}-$
	(1 mark)

(III) To the third portion all the sodium hydrogen carbonate

Observation	inferences
effervescence/bubble (1 mark)	$\text{H}^+ / \text{R} - \text{COOH}$ ✓1 Accept carboxylic acid for ½ mark
	(1 mark)

(b) You are provided with solid F. Carry out the tests below and record your observations and inferences in the spaces provided. Place all the solid F in a boiling tube. Add 10cm³ of distilled water. Divide into four portions.

observation	inferences
Solid <u>dissolves</u> to form a <u>colourless solution</u> ✓ ½ mark	Absence of coloured ions e.g. Cu^{2+} , Fe^{2+} , Fe^{3+} ✓ ½ mark

(i) To the first portion, add aqueous hydroxide drop wise until in excess.

observation	Inferences
No white ppt formed, even in excess (1 mark)	Zn^{2+} , Al^{3+} , Pb^{2+} , Mg^{2+} , Ca^{2+} absent Any 3 ions ✓1 Only 2 ion ✓ Reject Ba^{2+} absent
	(1 mark)

(ii) To the second portion add 5 drops of barium nitrate, followed by 3 drops of dilute nitric (V) acid

Observation	inferences
White ppt ✓ ½ formed. Ppt dissolves on ✓ ½ addition of nitric (v) acid (1 mark)	CO_3^{2-} ✓ ½ or SO_3^{2-} ✓ ½ present
	(1 mark)

iii) To the third portion add 3 drops of acidified sodium dichromate (VI) solution

Observation	inferences
$\text{K}_2\text{Cr}_2\text{O}_7$ changes ✓1 from orange to green (1 mark)	SO_3^{2-} ✓1 present
	(1 mark)