MAKINDU DISTRICT INTER – SECONDARY SCHOOL EXAMINATION 2014
233/3
CHEMISTRY
PAPER 3
CONFIDENTIAL INSTRUCTIONS TO SCHOOLS

In addition to the fittings and apparatus in a chemistry laboratory, each candidate will require the following

- A burette
- A 25cm^3 pipette
- A pipette filler
- 2 conical flasks
- Distilled water in a wash bottle
- A stand and a clamp
- 150cm^3 of solution A
- 100cm^3 of solution B
- 80cm^3 of solution C
- Boiling tube
- 6 dry test tubes in a rack
- Test tube holder
- Metallic spatula
- 0.5g solid E
- About 2g solid F
- 5mls liquid K

ACCESS TO

- Methyl orange indicator
- 2M sodium hydroxide solution
- Aqueous ammonia (2M $NH_{3(aq)}$)
- 0.5M lead nitrate solution
- Acidified $KMnO_4$
- Acidified $K_2Cr_2O_7$
- Sodium chloride solution

NOTES

1. Solution A is prepared by adding 12.9cm^3 of concentrated hydrochloric acid (specific gravity 1.18) to 600cm^3 of distilled water then top up to one litre
2. Solution B is prepared by dissolving 4g of sodium hydroxide in 600cm^3 of distilled water then top up to one litre.
3. Solution C is prepared by dissolving a mixture of 8.4g of sodium hydrogen carbonate and 1.6g of sodium chloride is about 600cm^3 of distilled water and then top up to one litre.

NAME ……..…….. **DATE** ……

INDEX NO. ……..……..……...…..… **SIGNATURE** ……..……..

233/3
CHEMISTRY
PRACTICAL
PAPER 3
JULY/AUGUST, 2014
TIME: 2¼ HOURS.

MAKINDU DISTRICT INTER – SECONDARY SCHOOLS EXAMINATION

Kenya Certificate of Secondary Education.

233/3
CHEMISTRY
PAPER 3
PRACTICAL
TIME: 2¼ HOURS.

INSTRUCTIONS TO CANDIDATES.

- Write your name and index number in the spaces provided above.
- Sign and write the date of exam in the spaces above.
- 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 2¼ hours allowed time for the paper.
- Use the 15 minutes to read through the question paper and note the chemicals you require
- Mathematical tables and electronic calculators may be used.
- All working **MUST** be clearly shown where necessary.
- This paper consists of 6 printed pages. Candidates should check to ensure that all pages are printed as indicated and no questions are missing

FOR EXAMINER'S USE ONLY.

Question	Maximum score	Candidate's score
1	18	
2	12	
3	10	
Total score	40	

Question 1

You are provided with:

- Dilute hydrochloric acid solution A
- 0.1m sodium hydroxide solution B
- 10g of a mixture of sodium hydrogen carbonate and sodium chloride per litre, solution C

You are required top determine;

(i) Molarity of solution A

(ii) Percentage purity by mass of sodium hydrogen carbonate

PROCEDURE 1

Fill the burette with solution A. Pipette 25cm3 of 0.1M sodium hydroxide solution B into a clean conical flask and add 2 drops of methyl orange indicator and titrate with solution A until a permanent pink colour occurs. Fill in the table below. Repeat the titration two more times and complete the table below.

TABLE I

	1	2	3
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution A used (cm^3)			

(4 Marks)

(a) Calculate the average volume of solution A used. (1 Mark)

……

……...

(b) Calculate the number of moles of hydrochloric acid solution A that reacted with 25cm3 of sodium hydroxide solution B. (2 Marks)

……

……...

(c) Calculate the concentration of solution A in moles per litre (1 Mark)

……

……...

……

……...

PROCEDURE II

Pipette 25cm3 of solution C into a conical flask, Titrate with solution A using 3 drops of methyl orange indicator. Record your results in table II below.

TABLE II

	1	2	3
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution A used (cm^3)			

(4 Marks)

(a) Calculate the average volume of solution A used. (1 Mark)

……

……...

……

……...

(b) Write an ionic equation for the reaction taking place between solution A and mixture C. (1 Mark)

……

……...

(c) Calculate:

(i) Molarity of sodium hydrogen carbonate in moles per litre (2 Marks)

……

……...

……

(ii) Mass of sodium hydrogen carbonate in moles per litre (1 Mark)

……

……...

……

……...

(iii) Mass of sodium chloride in the mixture (1 Mark)

……

……...

2. (I) You are provided with solid F. Carry out the following tests and write down all the observations and Inferences.

(a) Place half spatula end full of solid F in a dry test tube. Heat gently then strongly until there is no further change. Test gas using a glowing splint.

Observations	Inferences
(1 mark)	(1 mark)

(b) Place the remaining solid F in a test tube, add about $10cm^3$ of distilled water and shake vigorously. Divide the mixture into three portions.

(i) To the first portion, add 2M sodium hydroxide solution drop wise until in excess.

Observations	Inferences
(1 mark)	(1 mark)

(ii) To the 2nd portion, add ammonia solution dropwise till in excess.

Observations	Inferences
(1 mark)	(1 mark)

(iii) To the 3rd portion, add 4 drops of solution chloride

Observations	Inferences
(1 mark)	(1 mark)

II

You are provided with liquid K, carry out the following tests on it.

(a) Place about one spatula end full of liquid K on a metallic spatula and ignite it in a Bunsen burner flame.

Observations	Inferences
(1 mark)	(1 mark)

(b) To 2cm3 of liquid K add 3 drops of acidified $KMnO_4$ solution.

Observations	Inferences
(½ mark)	(½ mark)

(c) To 2cm3 of liquid K, add 3 drops of acidified $K_2Cr_2O_7$.

Observations	Inferences
(½ mark)	(½ mark)

3. You are provided with solid E. Carry out tests below. Record your observations and inferences in the spaces provided.
   (a) Put about one half of solid E in a dry test tube and heat it strongly. Test for any gas produced using litmus paper.

Observations	Inferences
(2 mark)	(2 mark)

   (b) Dissolve the rest of the solid E in 10cm3 of distilled water in boiling tube. Divide solution into 3 portions.

(i) To a first portion in test-tube, add aqueous sodium hydroxide dropwise until in excess.

Observations	Inferences
(1 mark)	(1 mark)

(ii) To the second portion in test tube, add aqueous ammonia solution dropwise until in excess.

Observations	Inferences
(1 mark)	(1 mark)

(iii) To the third portion in a test-tube, add lead (II) nitrate solution and then warm the mixture.

Observations	Inferences
(1 mark)	(1 mark)

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CHEMISTRY

PAPER 3

1. Procedure 1

Table 1

Table 1	I	II	III
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution A used (cm^3)			

Complete table✓(1mk)

Penalize to a maximum of 1/2mk for

- Inverted table
- Wrong arithmetic
- Burrette readings beyond $50cm^3$ except where explained
- Unrealistic titre values (below $1cm^3$) and above $50cm^3$

Use of decimals ✓(1mk)

- Accept for 1mk;
- One decimal or 2 decimal places throughout otherwise penalize fully
- If 2 decimal places are used; the second digit after the decimal is either '0' or 5 otherwise penalize fully.

Accuracy

Compare with the school/ teachers titre values if any

- Within ± 0.1 of T.V✓$^1/_2$mk
- Within ± 0.2 of T.V✓$^1/_2$mk
- Non-within ± 0.2 of each other T.V✓(0mk)

Averaging

- If 3 averaged and within± 0.2 of each other✓(1mk)
- If 2 averaged and within± 0.2 of each other ✓(1mk)
- Averaging outside the range± 0.2 (1mk)

PROCEDURE I

TABLE I

a) Average volume of solution A $= \frac{3\ titre\ values\ within \pm 0.2}{3}$ ✓ ½ mk

=correct answer ✓ ½ mk

or $\frac{2\ titre\ values\ within \pm 0.2}{2}$ ✓ ½ mk

Correct answer ✓ ½ mk

b) Moles of solution A used

0.1M NaOH ⟶ 0.1 moles in $1000cm^3$

if $1000cm^3$=0.1moles✓$^1/_2$mk

$25cm^3$= ?

$\frac{25cm^3}{1000} x 0.1 moles = 0.0025$ ✓ ½ mk

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

mole ratio base:Acid=1:1✓ ½ mk

Mole of HCl solution A that reacted with NaOH=0.0025 ✓ ½ mk

c) Concentration of solution A in moles per litre.

=Ans(a) contains 0.0025moles (Ans b) ✓½ mk

$1000cm^3$ = ?

$=\frac{1000cm^3}{Ans\ (a)} x 0.0025\ moles$

Correct answer. ✓½ mk

Procedure II

Table 2	I	II	III
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution A used (cm^3)	16.0	16.0	16.0

a) Average of volume of solution A

$=\frac{3\ titre\ values\ within \pm 0.2}{3}$ ✓½ mk

correct ans✓½ mk

b) $H^+_{(aq)}+HCO_3^-{}_{(aq)} \longrightarrow H_2O_{(l)}+CO_{2(g)}$✓(1mk)

c) i) Morality of sodium hydrogen carbonate in mols/l

Moles of solution A used

$=\frac{ans(c)procedure\ 1 x ans(a)procedure\ II}{1000}$ ✓½ mk

Mole ratio acid: Hydrogen carbonate

1:1

Moles of sodium hydrogen carbonate solution C used

$=\frac{Ans(c)procedure\ I x\ Ans\ (a)procedure\ II}{1000}$ ✓½ mk

Therefore

Molarity of $NaHCO_3$ $=\frac{1000 x ans(c)procedure\ I x\ ans\ (a)procedure\ II}{1000x25}$ ✓½ mk

$=\frac{Ans.(c)procedure\ I\ x\ Ans\ (a)procedure}{25}$

= Correct answer ✓½ mk

Procedure II

c) ii Mass of sodium hydrogen carbonate in moles/l

RMM of NaHCO3=23+1+12+(16x3)

=36+48

=84

.: , Mass of $NaHCO_3$ in the mixture in grammes per litre

= 84x ans (c) (i) √½ mk

= correct answer ✓½mk

iii) Mass of NaCl in the mixture

= 10-ans (c ii) ✓½mk

= Correct Ans✓½mk

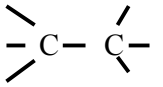
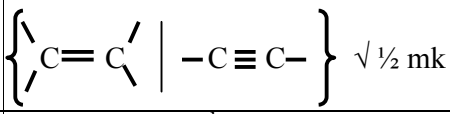
iv) % purity of $NaHCO_3$ = $\frac{ans\ (c\ ii) x 100}{10}$✓½mk

Qn2. I

a) Observations	Inference
– Colorless liquid forms on cooler sides of test tubes – Colorless gas produced which relights a glowing splint Each 1/2mk max 1	Solid F is hydrated $^1/_2$mk NO_3^- ions present ½ mk

b) Observation	Inference
i) White ppt✓$^1/_2$mk ii) White ppt✓$^1/_2$mk insoluble in excess✓$^1/_2$mk iii)No white precipitate formed 1mk	Al^{3+},Zn^{2+} or Pb^{2+} ions present 1mk for 3 cations, ½ for 3cations 0mk for cat ion Al^{3+} or Pb^{2+} $^1/_2$mk present Al^{3+} present ✓^{1}/2mk or Pb^{2+} absent ✓$^1/_2$mk

II

a)Burns with a blue smokeless flame (1mk)	Saturated organic compound or hydrocarbon with low C:H ratio or  √ (1mk)
b) Purple $KMnO_4$ turns colorless ½ mk	R- OH or  √ ½ mk
c) Orange $K_2Cr_2O_7$ turn green ½ mk	R-OH present✓$^1/_2$mk

Q3.

a) Observation	Inference
– Colourless liquid form✓$^1/_2$ mk – Vapour condenses on cooler part of test tube $^1/_2$mk – Red litmus remains red$^1/_2$mk – Blue litmus turns red – Yellow solid when hot white when cold✓ $^1/_2$ mk Reject water forms	Contains water of crystallization Hydrated salt ✓$^1/_2$ mk Acidic gas ✓$^1/_2$mk ZnO

b) Observation	Inference
White ppt✓$^1/_2$mk Dissolve in excess✓$^1/_2$mk	$Pb^{2+,}$ Zn^{2+}, Al^{3+} present

3 ions 1mk
2 ions ½ mk
1ions 0mk

c)Observation	Inference
– White precipitate✓$^1/_2$mk – Dissolves in excess✓$^1/_2$mk	Zn^{2+} present

Award zero for any contradictory ion.

d) Observation	Inference
– White ppt✓$^1/_2$mk – Dissolves on warming$^1/_2$mk	Cl^- present

Any contradictory ion award zero.