

Name: Index no

School: Candidate's sign

Date: Class.....

233/3

CHEMISTRY

JUNE 2014

TIME: 2 ¼ HOURS

KASSU JOINT EXAMINATION

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

INSTRUCTIONS TO CANDIDATES:

- Answer all the questions in the spaces provided in the question paper.
- You are **NOT** allowed to start working with 2 ¼ hours allowed for this paper. This time is to enable you read the question paper and make sure you have all the chemicals and apparatus that you may need.
- All working **MUST** be clearly shown.
- Mathematical tables, and calculators may be used.

For Examiner's Use Only:

Question	Maximum score	Candidates score
1	15	
2	10	
3	15	
Total score	40	

This paper consists of 6 printed pages. Candidates should check to ascertain that all papers are printed as indicated and that no questions are Missing

1. You are provided with:
- Solid Q, 2.0 g of impure sodium carbonate (contaminated with sodium chloride).
 - Solution R, hydrochloric acid solution, containing 2.07 g of the acid in 500 cm³ of solution.

You are required to determine the percentage impurity in solid Q.

Procedure

- Place all solid Q in a beaker and add 100 cm³ of distilled water. Stir well with a glass rod.
- Transfer the solution into a 250 cm³-volumetric flask and top it up to the mark with distilled water. Shake well and label as solution Q.
- Fill a burette with solution R.
- Pipette 25.0 cm³ of solution Q into a conical flask. Add three drops of methyl orange indicator.
- Titrate solution Q against solution R from the burette. Record the results in the table below.
- Repeat the titration two more times and complete the table.

	I	II	III
Final burette reading(cm ³)			
Final burette reading(cm ³)			
Volume of solution R used (cm ³)			

- (a) Determine the average volume of solution R used. (4 marks)
(1 mark)
- (b) Calculate the concentration of solution R in moles per litre. (2 marks)
 (H=1.0, Cl=35.5)
- (c) Calculate the number of moles of the acid in solution R that reacted. (1 mark)

(d) Write an equation for the reaction that occurs. (1 mark)

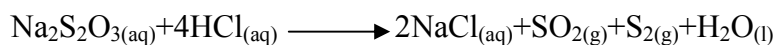
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(e) Calculate the number of moles of sodium carbonate in 25 cm³ of solution Q that reacted. (1 mark)

(f) Calculate the mass of sodium carbonate in 250 cm³ of solution Q. (2 marks)
(C=12.0, O=16.0, Na=23.0)

(g) Find the percentage by mass of the impurity, sodium chloride, in solid Q. (2 marks)

2. You are required to investigate the effect of change in concentration on the reaction rate between sodium thiosulphate solution C and dilute hydrochloric acid solution D. When hydrochloric acid is added to sodium thiosulphate sulphur is deposited.



The time taken for sulphur to reach a certain amount can be used to indicate the rate of the reaction. Solution C contains 0.08 moles of sodium thiosulphate in one litre of solution.

Procedure II

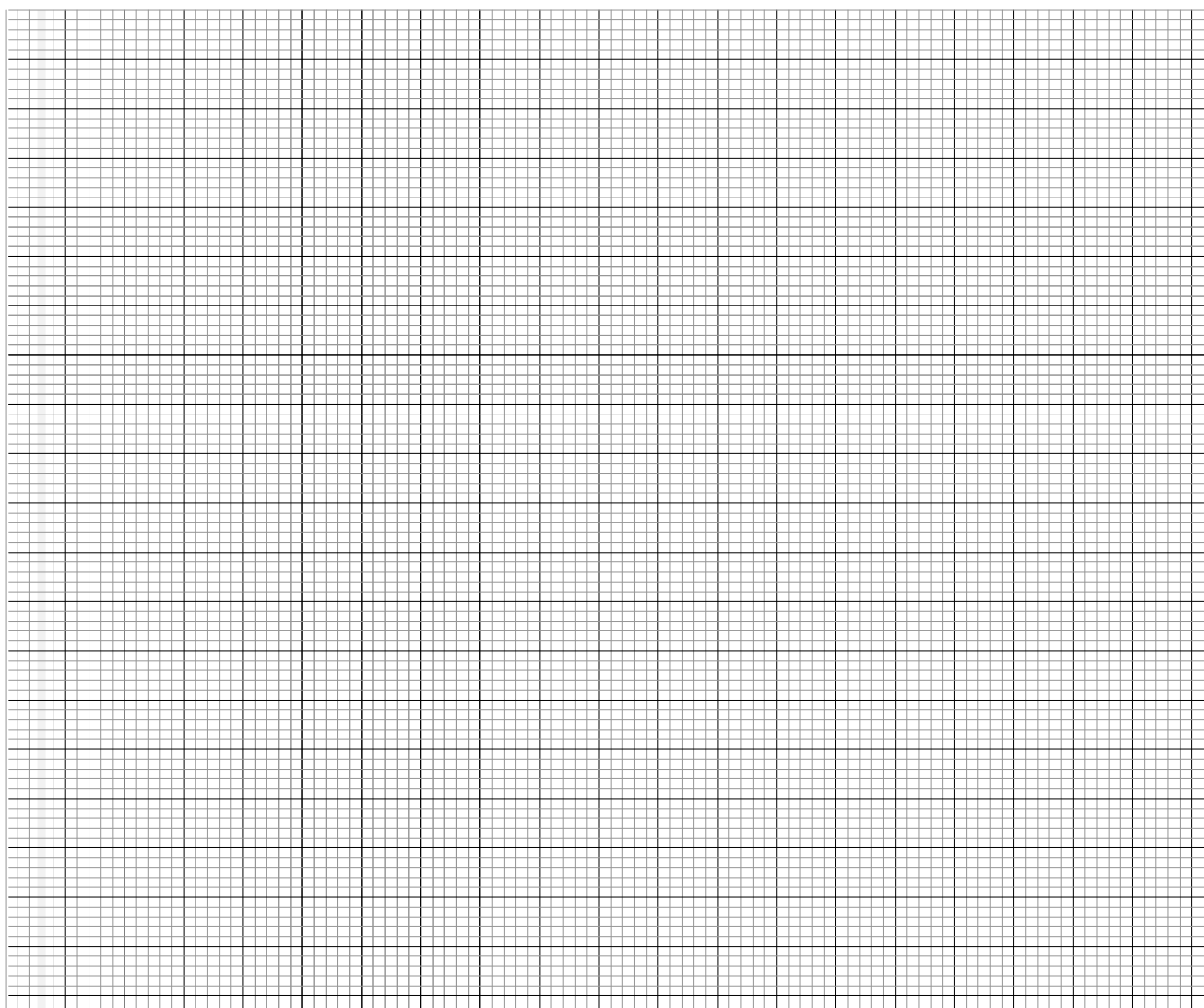
- i. Measure 40cm³ of solution C and pour it into a 100cm³ glass beaker.
- ii. Mark a cross (X) on a white paper. Place the beaker containing solution C over the cross on the paper.
- iii. Measure 10cm³ of solution D and add it to the solution C in the beaker. Start the stopwatch immediately. Observe the cross on the white paper from the top of the beaker and record the time taken for it to be obscured (to disappear from view).

- iv. Repeat the experiment using different volumes of solution C as indicated in the following table and in each case water is added to make a total of volume of 40cm^3 . The same volume of hydrochloric acid is added in each case.

Complete the table below. (5 Marks)

Volume of HCl used (cm^3)	Volume of $\text{Na}_2\text{S}_2\text{O}_3$ used cm^3 solution.	Volume of water added	Time taken (s)	$\frac{1}{\text{time}(\text{s}^{-1})}$
10	40	0		
10	30	10		
10	25	15		
10	20	20		
10	10	30		

- I. On the grid provided plot a graph of the reciprocal of time $\frac{1}{\text{time}} (\text{s}^{-1})$ y-axis against volume of solution C used. (3Marks)



II. From the graph determine the time taken for the cross to disappear if 35cm³ of solution C was used. (1mks)

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III. Explain the shape of the graph in terms of rates of reaction. (1mk)

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3. I) You are provided with solid **K**. Carry out the tests below. Write your observations and inferences in the spaces provided.

Place all of solid K in a boiling tube, add about 10 cm³ of distilled water and shake until all the solid dissolves. Divide the solution into 4 portions.

a) To the first portion in a test -tube, add a few drops of sodium hydroxide until in excess. **Retain** the mixture for procedure (b)

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

b) Warm the mixture in (a) above and test any gases produced using red and blue litmus papers.

OBSERVATIONS	INFERENCE
(1 mark)	(1mark)

c) To the third portion, add about equal volume of freshly prepared lead (II) nitrate solution followed by a few drops of dilute nitric (V) acid.

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

d) To the fourth portion add Barium nitrate solution

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

II) You are provided with substance Z. Carry out the tests below. Write your observations and inferences in the spaces provided.

a) Scoop a little of solid Z using a clean spatula and burn it in a Bunsen burner flame.

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

Divide the remaining amount into two portions.

b) To the first portion, add water and shake.

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

c) To the second portion, add potassium Manganate (VII) and warm.

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

d) To a little amount of Z, add sodium carbonate.

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

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MARKING SCHEME

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1.Awarding marks for the Table and averaging

- CT = complete table(maximum 1mk)

Conditions: -All three titrations done..... 1mk
-Two done..... 1 mk
- One done.....0mk

Penalize a maximum ½ mk for any one of the following:

- Unrealistic burette readings e.g. beyond 50 cm³
 - Wrong arithmetic
 - Inversion of the table
- D = Decimal place(maximum 1mk)
Conditions:- Tied to first and second rows only
-Use of one or two decimal places consistently. If two d.p. is used, then the second place must be 0 or 5.
Penalise fully for inconsistency in decimals as stated above.

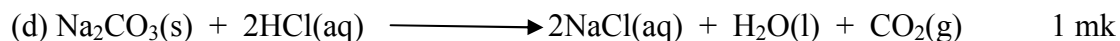
- Acc. = accuracy.....(maximum 1 mk)
Consider any one of the candidate's titre.
If within: ± 0.10cm³ of school value (s.v) award 1mk
± 0.20cm³ of school value (s.v) award ½mk
If beyond ± 0.20cm³ award 0mk
- PA = Principle of averaging(maximum 1mk)
(i)Three titres averaged are within ± 0.2cm³ of each other award 1 mk. If beyond this limit award 0mk.
(ii) Two titres averaged if only 2 titres are possible
(iii) If 2 titres are averaged when three are possible award 0mk.
- F.A = Final answer.....(maximum 1 mk)
Conditions: -Average titre to be recorded to 2d.p.
- The correctly averaged titre is compared to school value.
- Award marks as for accuracy:
Within ±0.10 cm³ of school value award 1mk
Within ± 0.20 cm³ of school value award ½mk

Calculations

(b) RMM of HCl=36.5 ½mk
Moles in 500 cm³ = 2.07/36.5 ½mk

= 0.05671
Moles in 1000 cm³ = 1000/500x0.05671 ½mk
= 0.1134
Molarity= 0.1134 M ½mk

(c) Average titre x Ans (b)//1000 ½mk
=0.002654 mol ½mk



(e) moles of $\text{Na}_2\text{CO}_3 = 1/2 \times$ moles of HCl in (c) above 1/2mk
 = correct ans 1/2mk

(f) RFM of $\text{Na}_2\text{CO}_3 = 106$ 1/2mk
 moles of $\text{Na}_2\text{CO}_3 = \text{Ans (e)} \times 250/25$ 1/2mk
 = correct ans 1/2mk

Mass = ans above x RFM 1/2mk
 = correct ans 1/2mk

(g) mass of NaCl = 2.0 – ans(f) 1/2mk
 =correct ans

Percentage = Ans above/2 x 100 1 mk
 = correct ans % 1/2mk

2. Completing the table 1/2 mark for each box correct to teachers value (10 x 1/2 = 5marks)

I Graph - Scale well labeled and covering 3/4 of graph (1mark)

Give a maximum of 1/2 marks for inverted axes

- Plotting all the points correctly (1mark)

Award half mark for 4 points correctly plotted and

- Smooth curve passing through all the points (1mark)

3marks

II Answer correctly obtained from graph drawn (1/2mk) . The reciprocal should be converted to time to qualify for second 1/2 mark. (1marks)

III the rate of reaction is directly proportional to $\frac{1}{time}$ (1mark)

3. I) You are provided with solid **K**. Carry out the tests below. Write your observations and inferences in the spaces provided.

Place all of solid **K** in a boiling tube, add about 10 cm³ of distilled water and shake until all the solid dissolves. Divide the solution into 2 portions.

- a) To the first portion in a test -tube, add a few drops of sodium hydroxide until in excess.

Retain the mixture for procedure (b)

Observations	Inferences
No white ppt✓ (1 mark)	NH ₄ ⁺ ,K ⁺ ,Na ⁺ ✓ (1 mark)

- b) Warm the mixture in (a) above and test any gases produced using red and blue litmus papers.

Observations	Inferences
A colourless gas is produced. Red litmus paper turns blue Blue litmus paper remains blue ½ mark each to a maximum of 1 mark (1 mark)	NH ₄ ⁺ confirmed✓ (tied to red litmus paper turning blue) (1 mark)

- c) To the last portion add 5 drops of aqueous sodium hydroxide then add the piece of aluminium foil provided to the mixture and shake. Warm the mixture and test any gases produced with both blue and red litmus papers.

Observations	Inferences
Effervescence. Colourless gas/gas with a pungent/choking smell Red litmus paper turned blue Blue litmus paper remained blue✓ ½ mk each to a maximum of 1 mk (1 mark)	NO ₃ ⁻ ✓ (tied to red litmus turning blue) (1 mark)

d) To the fourth portion, add lead (II) nitrate solution.

Observations	Inferences
White ppt√1 (1 mark)	Cl ⁻ √1 (1 mark)

II) You are provided with substance Z. Carry out the tests below. Write your observations and inferences in the spaces provided.

a) Soop a little solid Z using a clean spatula and burn it in a Bunsen burner flame.

Observations	Inferences
Burns with a non-sooty flame√1 (1 mark)	$\begin{array}{c} \quad \\ -C=C- \end{array}$ or $\begin{array}{c} -C\equiv C- \end{array}$ absence Low C :H ratio√1 (1 mark)

b) To about 2 cm³ of Z, add a little distilled and shake.

Observations	Inferences
Z is miscible with water√1 (1 mark)	Polar compound√1 (1 mark)

c) To a little amount of Z in at test- tube, add a few drops of acidified potassium manganate (VII) solution and warm the mixture.

Observations	Inferences
Acidified potassium manganate (VII) is decolorized // purple colour turns colourless✓ 1 (1 mark)	R-OH present✓ 1 (1 mark)

d) To a little amount of Z, add sodium carbonate.

Observations	Inferences
No effervescence//no bubbles✓ 1 (1 mark)	R-COOH absent or H^+ (H_3O^+) absent✓ 1 (1 mark)