233/3
CHEMISTRY
PAPER 3
PRACTICAL
JULY / AUGUST 2014

KANGUNDO DISTRICT FORM IV MULTILATERAL EXAMINATION 2014
Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 3

CONFIDENTIAL

1. About 200ml of solution Q.
2. About 300ml of solution R.
3. Pipette.
4. Burette.
5. Methyl orange.
6. Stand and clamp.
7. White tile.
8. Two conical flasks.
9. Two 250ml beakers.
10. 5g of potassium chlorate per student (Accurately).
11. Boiling tube.
12. $10cm^3$ measuring cylinder.
13. Thermometer.
14. About 0.5g o solid Q.
15. Distilled water in a wash bottle.
16. Six test tubes in a test tube rack.
17. Solid K.
18. A spatula.
19. 0.5g of $NaHCO_3$.

ACCESS

- Acidified potassium manganese (VII) solution.
- Bromine water.
- 0.5M lead (II) nitrate.
- 1M Barium nitrate.
- 2M Ammonia solution.
- 1M Na_2SO4 solution.
- Solid K – Succinic acid.
- Solid Q – Zinc sulphate.
- Sources of heat.

- Solution Q is 0.1M Na_2CO_3.
- Solution R is 0.25M HCl.

Name _____ Index No. _____

Candidate's Signature _____

Date _____

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2 ¼ HOURS

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INSTRUCTIONS TO CANDIDATES

- Answer ALL questions in the spaces provided.
- Mathematical tables and electronic calculators may be used
- All working MUST be clearly shown where necessary.

FOR EXAMINER'SUSE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 24	80	

This paper consists of 7 printed pages

Turn Over

1. You are provided with the following:
   - Solution Q which contains 5.3g of metal carbonate, M_2CO_3 in $500cm^3$ of solution.
   - Solution R which is 0.25M HCl.

You are required to determine the relative formula mass of metal M.

Procedure

- Pipette $25cm^3$ of solution Q into a conical flask.
- Add 2-3 drops of methyl orange indicator.
- Titrate the solution against solution R (hydrochloric acid) until the colour turns permanetely pink. Record your results in the table below. Repeat the experiment twice.

(4 marks)

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

(a) Calculate the average volume of solution R used. (1 mark)

(b) Find the number of moles of solution R that reacted. (1 mark)

(c) Find the number of moles of solution Q used. (2 marks)

(d) Determine the concentration of solution Q in:-
(i) Moles per litre. (1 mark)

(ii) Grams per litre (1 mark)

(e) Determine the relative atomic mass of M.
(C = 12.0, O = 16.0) (3 marks)

2. You are provided with 5g of potassium chlorate solid P. You are required to determine the solubility of potassium chlorate at different temperatures.

Procedure

Add all solid P in a boiling tube. Using a measuring cylinder add 15cm^3 of distilled water to the boiling tube. Warm the mixture until all the solid dissolves. Stir the solution gently with a thermometer and cool it under tap water. Note and record the temperature at which crystals just appear. Add 5cm^3 of distilled water to the solution and repeat procedure above. Continue adding 5cm^3 portions until the volume in 40cm^3 while noting the temperature at which crystals just appear in each case. Record your results in the table below.
(1 ½ marks)

Volume of water	15	20	25	30	35	40
Crystallization temperature						
Solubility of $KClO_3$ per 100g of water						

(b) Calculate the solubilities of potassium chlorate in grams per 100g of water and record your results in the table above. (1 ½ marks)

(c) Plot a graph of solubility against temperature. (3 marks)

(d) From the graph determine:-
(i) Solubility of $KClO_3$ in g/100g of water at 25^0C. (1 marks)

(ii) The temperature when solution contains 30g of potassium chlorate. (1 mark)

(e) How does solubility of potassium chlorate vary with temperature. (1 mark)

3. (a) You are provided with solid Q. You are required to carry out the tests and record your observations and inferences in the spaces provided.
Dissolve all the solid provided in about $10cm^3$ of water and divide the resulting solution into five equal portions

(i) To the first portion, add about $1cm^3$ of sodium sulphate solution.

Observations	Inferences
(1 mark)	(1 mark)

(ii) To the second potion, add ammonia solution dropwise until in excess.

Observations	Inferences
(1 mark)	(1 mark)

(iii) To the third portion, add barium nitrate solution followed by excess dilute hydrochloric acid solution.

Observations	Inferences
(1 mark)	(1 mark)

(iv) To the fourth portion, add lead (II) nitrate solution and warm.

Observations	Inferences
(1 mark)	(1 mark)

(b) (i) You are provided with solid K, carry out the following tests and record your observation and inferences in the spaces provided. Scoop a third of the provided with a spatula and heat it on a non-luminous Bunsen burner

Observations	Inferences
(1 mark)	(1 mark)

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MARKING SCHEME

1.

	1	2	3
Final burette reading (cm^3)	20.00	20.00	20.00
Initial burette reading (cm^3)	0.00	0.00	0.00
Volume of solution R used (cm^3)	20.00	20.00	20.00

CT 1 mk
DP 1 mk
Con 1 mk
Acc 1 mk

(a) $\frac{20.00 + 20.00 + 20.00}{3}$

$= 20.00cm^3$

(b) $0.25 \longrightarrow 1000cm^3$

$? \longleftarrow 20cm^3$

$\frac{20}{1000} \times 0.25$

$= 0.005$ moles √1

(c) $M_2CO_{3\,(aq)} + 2HCl_{\,(aq)} \longrightarrow 2MCl_{\,(aq)} + CO_{2\,(g)} + H_2O_{\,(l)}$ √ ½ mol

Mol ratio M_2CO_3 : HCl

1 : 2 √ ½

∴ moles of Q = $\frac{0.005}{2}$

$= 0.0025$ moles √1

(d) $25cm^3 \longrightarrow 0.0025$ moles

$1000cm^3 \longrightarrow ?$

$\frac{1000}{25} \times 0.0025$

$= 0.1M$ √1

This paper consists of 2 printed pages

Turn Over

(ii) $5.3g \longrightarrow 500cm^3$
$? \longleftarrow 1000cm^3$

$\frac{1000}{500} \times 5.3$

$= 10.6g \surd 1$

(e) Molarity $= \frac{\text{mass}}{\text{Molar mol}}$ M_2CO_3

$0.1 = \frac{10.6}{x}$ $12 + 48 + 2M = 106$

$60 + 2M = 106 \surd ½$ ml

$2M = 106 - 60$

$x = \frac{10.6}{0.1}$ $\frac{2M}{2} = \frac{46}{2}$

$x = 106g \surd 1$ $M = 23 \surd ½$

2.

Volume of water	15	20	25	30	35	4
Crystallization temperature	75.00	65.00	52.00	44.00	38.00	33.00
Solubility of $KClO_3$ per 100g of water	33.33	25.00	20.00	16.67	14.28	12.5

(c) SC
3 plotted points
Labelled Axis
Scale – appropriate

Filling temp 1 ½ mks
Solubilities 1 ½ mk s

(d) From students curve
(e) Solubility increases with increase in temperature

3

	Observations	Inferences
3 (a) (i)	No white precipitate observed (1 mark)	Ba^{2+}, Pb^{2+}, Ca^{2+}, ions absent (1 mark)
(ii)	White precipitated that dissolve in excess (1 mark)	Zn^{2+} present (1 mark)
(iii)	White precipitate that persists in dilute nitric acid. (1 mark)	$SO4^{2-}$ present (1mark)
(iv)	White precipitate that persists on warming. (1 marks)	Cl- absent (1 mark)
(b)(i)	Burns with a sooty yellow flame. (1 mark)	$\begin{vmatrix} & \\ C = C & , -C \equiv C - \\ \end{vmatrix}$ present (1 mark)
(ii)	Acidified potassium manganate (VII) is decolourised. (1 mark)	$\begin{vmatrix} & \\ C = C & , -C \equiv C - \\ \end{vmatrix}$ present (1 mark)
(iii)	Bromine water is decolourised (1 mark)	$\begin{vmatrix} & \\ C = C & , -C \equiv C - \\ \end{vmatrix}$ present (1 mark)
(iv)	Effervescence / fizzing bubbles (1 mark)	H_3O^+ / H^+ present (1 mark)