233/3
CHEMISTRY
PAPER 3
PRACTICAL
JULY / AUGUST 2014

KILUNGU DISTRICT JOINT EXAMINATION
Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 3

CONFIDENTIAL

Each candidate should be provided with:

1. About $50cm^3$ of solution P.
2. About $100cm^3$ of solution R.
3. A pipette with pipette filler.
4. Filter funnel.
5. Burette.
6. 2 pieces conical flasks (250ml each).
7. Glass rod.
8. Volumetric flask (250ml).
9. About 250ml distilled water in a wash bottle.
10. Filter paper.
11. Solid Q 0.6g Accurately weighed.
12. About 1g of solid E.
13. 1 red and 1 blue litmus papers.
14. 6 test tubes in a rack.
15. About 1g of solid F.
16. Metallic spatula.

In addition each candidate should access.

1. 2M ammonia solution.
2. 2M dilute nitric acid.
3. 0.1M barium nitrate solution.
4. 0.1M potassium iodide.
5. Bromine water.
6. Acidified $K_2Cr_2O_7$.
7. 0.1g $NaHCO_3$ solid.
8. Universal indicator + pH chart.
9. Source of heat.

NOTES

Solid Q	:	Mixture of 0.5g Na_2CO_3 + 0.1g $CaCO_3$.
Solution P	:	Dissolve $172cm^3$ of conc. HCl in distilled water and make to 1 litre solution.
Solution R	:	Dissolve 12g of NaOH pellets in 1 litre solution.
Solid E:	:	Is aluminium sulphate.
Solid F	:	Oxalic acid..
Bromine water	:	Dissolve $1cm^3$ of Bromine liquid in $99cm^3$ of distilled water

This paper consists of 1 printed page

Name _____ Index No. _____

Candidate's Signature _____

Date _____

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CHEMISTRY
PAPER 3
PRACTICAL
JULY / AUGUST 2014
2 ¼ HOURS

KILUNGU DISTRICT FORM 4 JOINT EXAMINATION
Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 3
2 ¼ HOURS

INSTRUCTIONS TO CANDIDATES

- Answer all questions in the spaces provided.
- You are not allowed to start working with apparatus for the first 15 minutes of the 2 ¼ hrs 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 you need.
- All working must be shown clearly.

Calculators and mathematical tables may be used.

FOR EXAMINER'SUSE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	18	
2	10	
3	12	
TOTAL SCORE	**40**	

This paper consists of 6 printed pages

Turn Over

1. You are provided with:
   - Solid Q a metal carbonate X_2CO_3
   - Solution P hydrochloric acid
   - Solution R, 0.3M sodium hydroxide

You are required to:-

(i) Prepare a dilute solution of hydrochloric acid and determine its concentration.

(ii) Determine the solubility of solid Q in water.

Procedure

(a) Place all solid Q in 250ml dry beaker. Add 100cm^3 of distilled water. Using a glass rod, stir the mixture thoroughly for about two minutes. Leave the mixture to stand and proceed with steps (b) and (c)

(b) Using a pipette place 25cm^3 of solution P in 250ml volumetric flask. Add about 200cm^3 of distilled water to make upto the mark. Label this as solution S.

(c) Fill a burette with solution R. Using a pipette place 25cm^3 of solution S into 250cm^3 conical flask. Add two drops of the indicator provided and titrate solution S against solution R. Record your results in table I. Repeat the titration two more times and complete table I. (Retain the remaining solution S for use in step (e).

(d) Filter the mixture obtained in step I using a dry filter funnel into a dry conical flask. Label the filtrate as solution Q.

(e) Clean the burette and fill it with solution S. Using a pipette transfer 25cm^3 of solution Q into a 250cm^3 conical flask. Add two drops of the indicator provided and filtrate solution Q with solution S. Record your results in table II. Repeat the titration two more times and complete table II.

Table I

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

(4 marks)

(a) Calculate:

(i) Average volume of solution R used. (1 mark)

(ii) Moles of sodium hydroxide in the average volume of solution R used. (1 mark)

1. You are provided with:
   - Solid Q a metal carbonate X_2CO_3
   - Solution P hydrochloric acid
   - Solution R, 0.3M sodium hydroxide

You are required to:-

(i) Prepare a dilute solution of hydrochloric acid and determine its concentration.

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Procedure

(a) Place all solid Q in 250ml dry beaker. Add 100cm^3 of distilled water. Using a glass rod, stir the mixture thoroughly for about two minutes. Leave the mixture to stand and proceed with steps (b) and (c)

(b) Using a pipette place 25cm^3 of solution P in 250ml volumetric flask. Add about 200cm^3 of distilled water to make upto the mark. Label this as solution S.

(c) Fill a burette with solution R. Using a pipette place 25cm^3 of solution S into 250cm^3 conical flask. Add two drops of the indicator provided and titrate solution S against solution R. Record your results in table I. Repeat the titration two more times and complete table I. (Retain the remaining solution S for use in step (e).

(d) Filter the mixture obtained in step I using a dry filter funnel into a dry conical flask. Label the filtrate as solution Q.

(e) Clean the burette and fill it with solution S. Using a pipette transfer 25cm^3 of solution Q into a 250cm^3 conical flask. Add two drops of the indicator provided and filtrate solution Q with solution S. Record your results in table II. Repeat the titration two more times and complete table II.

Table I

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

(4 marks)

(a) Calculate:

(i) Average volume of solution R used. (1 mark)

(ii) Moles of sodium hydroxide in the average volume of solution R used. (1 mark)

(iii) Moles of hydrochloric acid in 25.0cm^3 of solution S . (1 mark)

(iv) The molarity of hydrochloric acid solution S. (1 mark)

Table II

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

(4 marks)

(b) Calculate

(i) Average volume of solution S used. (1 mark)

(ii) Moles of hydrochloric acid in the average volume of solution S used. (1 mark)

(iii) Moles of the metal carbonate; solid Q in 25cm^3 of solution Q. (2 marks)

(iv) The solubility of the metal carbonate solid Q in water (Relative formula mass of metal carbonate = 74 assume density of solution is 1g/cm^3) (2 marks)

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

(a) Place half of the solid E in a dry test tube and heat. Test any gases produced using litmus papers.

Observation	Inference
(2 marks)	(1 mark)

(b) Add about 10cm^3 of distilled water to the remaining solid in a test tube and shake. Divide the solution into 3 portions.

(i) To the first portion, add barium nitrate about 1cm^3 and about 2cm^3 of dilute nitric (V) acid.

Observation	Inference
(1 ½ marks)	(1 mark)

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

Observation	Inference
(1 ½ marks)	(1 mark)

(iii) To the 3rd portion, add 3 drops of potassium iodide solution.

Observation	Inference
(1 mark)	(1 mark)

3. You are provided with solid F. You are required to carry out the test below.

(a) Divide solid F into two equal parts. To the first portion, ignite using a metallic spatula and a blue Bunsen burner flame

Observation	Inference
(1 mark)	(1 mark)

(b) Place the remaining portion of solid F in a test tube and add $10cm^3$ of distilled water

Observation	Inference
(1 mark)	(1 mark)

(c) (i) To 2cm^3 of solution F above add 3 drops of bromine water

Observation	Inference
(1 mark)	(1 mark)

(ii) To 2cm^3 of solution F add 3 drops of acidified $K_2Cr_2O_7$.

Observation	Inference
(1 mark)	(1 mark)

(iii) To 2cm^3 of solution add 0.1g of sodium hydrogen carbonate provided

Observation	Inference
(1 mark)	(1 mark)

(iv) To 2cm^3 of solution F add 3 drops of universal indicator and determine the pH.

Observation	Inference
(1 mark)	(1 mark)

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MARKING SCHEME

1. Table I (5 marks)
Distributed as follows:

A. Complete table 1 mark
(i) Complete table with 3 titration 1 mark
(ii) Incomplete table with 2 titration done ½ mark
(ii) Incomplete table with 1 titration done 0 mark

Penalties
(i) Wrong arithmetic / subtraction.
(ii) Inverted table.
(iii) Burette readings beyond $50cm^3$ unless explained.
(iv) Unrealistic titre values (below $1cm^3$ or above $100cm^3$).

NOTE: Penalise ½ mark each to a maximum of ½ mark

B. Use of decimals 1 mark
(Tied to 1st and 2nd rows of the table)

- Accept 1 or 2 decimal places used consistently otherwise penalize fully i.e. award 0 mark.
  - If 2 decimal places MUST have '0' or'5' otherwise penalize fully.
  - Accept inconsistency of the zeros as the initial burette readings e.g 0, 0.0, 0.00

C Accuracy 1 mark
Compare the candidates titre values with the school values and ticks (√) the value if it earn a mark.

Conditions
(i) If atleast one value is within ± 0.1 of school value 1 mark
(ii) If no value within 0.1 but one is within ± 0.2 of school value ½ mark
(iii) If no value is within 0.2 of school value award 0 mark

NB: If there was wrong arithmetic in the table, compare the school value with the correctly worked out value and award accordingly.

This paper consists of 3 printed pages

Turn Over

D. Principles of averaging 1 mark
(Values averaged MUST be within ± 0.2 from one another and MUST be shown)

Conditions:
- If 3 titrations are done and averaged 1 mark
- If 3 titrations are done but only 2 are consistent and averaged award 1 mark
- If 2 titrations are done and are averaged award 1 mark
- If 3 titrations are possible but only 2 are averaged award 0 mark
- If 1 titration is done award 0 mark

Penalties
(i) Penalise ½ mark for wrong arithmetic in the average titre if the error is outside ± 2 units in the 2nd dip.
(ii) Penalise ½ mark if no working is shown and the answer given is correct.
(iii) Penalise FULLY if no working is shown and answer given is wrong.
(iv) Accept rounding off of answer to 2 d.p otherwise penalize wrong rounding off.

NOTE: - Accept answers to 1 d.p or whole numbers if it works out correctly and credit fully.
- a(i) must be marked before awarding for principles of averaging.

E. Final accuracy 1 mark
(Tied to averaged titre)
Compare the correct average titre value with the school value and if:
(i) Within ± 0.1 of school value award 1 mark
(ii) If not within ± 0.1 but within ± 0.2 of school value award ½ mark
(iii) If not within ± 0.2 of school value award 0 mark

NOTE:
(i) If there are two possible pairs of titre values that can be averaged, use the pair that is closed to the school value.
(ii) If wrong values are averaged, pick the correct values (If any) following the principles of averaging, average and award accordingly.

Calculations
(a) (ii) Moles of NaOH in the average volume of solution R used

$$= \frac{\text{Average titre} \surd \tfrac{1}{2} \times 0.3}{1000} = \text{C.A.O} \surd \tfrac{1}{2}$$

(iii) Moles of HCl in $25cm^3$ of solution S
Mole ratio NaOH : HCl = 1 : 1 √ ½
Moles of HCl = ans a (ii) x $^1/_1$
= C.A.O √ ½

(iv) the molarity of HCl solution S

$$\frac{\text{Ans a(iii)} \surd \tfrac{1}{2} \times 1000}{25}$$

= C.A.O √ ½

OR

Ans a (iii) x 40 √ ½
= C.A.O √ ½

$M_a v_a = mbvb$

$\frac{M_a V_a}{M_b V_b} = \frac{1}{1}$

$M_a = \frac{0.3 \times AV.\ Titre}{25}$ = C.A.O

TABLE II 5 marks

(To be marked similar to table I)

Calculations

(b) (ii) Moles of hydrochloric acid in the average volume of solution S used

$= \frac{\text{Ans a (iv) ans b (i)}}{1000}$ √ ½

= C.A.O √ ½

(iii) Moles of metal carbonate, solid Q in $25cm^3$ of solution Q

Ratio acid : metal carbonate = 2 : 1 √ ½

Moles of metal carbonate = $\frac{\text{Ans b(ii)}}{2}$ √1

= C.A.O √ ½

(iv) The solubility of metal carbonate, solid Q in water

Mass of solution = volume x density

= 25 x 1

= 25g

Mass of metal carbonate = mol x R.M.M

= Ans b (iii) x 74 √ ½

= C.A.O (A)

Mass of water (solvent) in $25cm^3$ of solution

25 - ans (A) above √ ½

= C.A.O (B)

Solubility of M_2CO_3 (Solid Q) $= \frac{\text{Ans A x 100}}{\text{Ans B}}$ √ ½

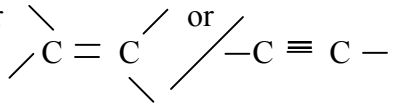
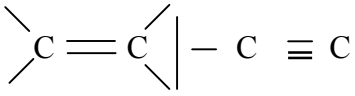
= C.A.O √ ½

Requirements

1) Pipette + pipette filler
Burette
Conical flasks (2 pieces) 250ml
Filter paper
Filter funnel
Glass rod
Volumetric flask 250ml
200ml distilled water
Methyl orange water
Solid Q – Mixture 0.5g of Na_2CO_3 + 0.1g of $CaCO_3$
Solution P – Prepared by dissolving $172cm^3$ of conc. HCl in distilled water and dilluting to 1 litre solution.

Solution C – prepared by dissolving 12g of NaOH pellets in 1 litre solution

2.

	Observation	Inferences
2 (a)	Colourless gas √ ½ which turn blue√ ½ litmus paper red √ ½ and red litmus remain red White residue √ ½	Acidic gas produced √1
B((i)	White ppt √1 Insoluble in acid √ ½	SO_4^{2-} present √1
(ii)	White ppt √1 Insoluble in excess √ ½	Al^{3+}, Pb^{2+} present √
(iii)	No yellow ppt √1	Al^{3+} present √1
3 (a)	Burns with a sooty / smoky flame	Organic compound with high C : H ratio Or  or Present
(b)	Dissolves to form a colourless solution	F is polar
c) (i)	Yellow colour of bromine water remains	 Absent
(ii)	Orange $K_2Cr_2O_7$ remains orange	R— OH absent
(iii)	Effervescence / gas bubbles	H+ / H_3O^+ Present
(iv)	pH = 4 or 5 or 6	R – COOH present