233/3
CHEMISTRY
PAPER 3
(PRACTICAL)

CONFIDENTIAL:

CENTRAL KENYA NATIONAL SCHOOLS JOINT EXAM - 2014

Requirements for each candidate:

1. $50cm^3$ of a saturated solution of sodium oxalate, solution A.
2. $150cm^3$ of 0.02M potassium manganate (VII), solution B.
3. $100cm^3$ of 0.1M ammonium iron (II) sulphate, solution C.
4. $50cm^3$ of 1M sulphuric (VI) acid.
5. Burette.
6. Pipette and pipette filler.
7. 2 conical flasks.
8. 10ml measuring cylinder.
9. 100ml measuring cylinder.
10. Filter funnel.
11. Thermometer.
12. Distilled water about ($500cm^3$)
13. Label.
14. White tile.
15. Liquid F about $10cm^3$
16. 0.5g of solid G in a stoppered container.
17. Metallic spatula.
18. About $500cm^3$ of distilled water.
19. About 0.2g of $NaHCO_3$
20. 6 test tubes.
21. One B. tube.
22. Red and blue litmus paper.
23. One filter paper watchman no.1 125mm.

Access to:

1. 2M sulphuric (VI) acid.
2. 2M sodium hydroxide.
3. 2M hydrochloric acid.
4. Bromine water.
5. Acidified potassium dichromate (VI).
6. Source of heat.

NOTE:

- Liquid F is liquid paraffin.
- Solid G is barium hydroxide.
- Solution A is prepared.

NAME…….. INDEX NO…….....

233/3 **CANDIDATE'S SIGN……..……..**
CHEMISTRY
PAPER 3 **DATE……..……**
(PRACTICAL)
JULY/AUGUST, 2014
TIME: 2¼ HOURS

CENTRAL KENYA NATIONAL SCHOOLS JOINT EXAM - 2014

Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 3
(PRACTICAL)
TIME: 2¼ HOURS

INSTRUCTIONS TO CANDIDATES:

- Answer **ALL** questions in the spaces provided for each question.
- You are **NOT** allowed to start working with the apparatus for the first 15 minutes of 2¼ hours. This time enables you to read the questions and ensure you have all the chemicals and apparatus that you may need.
- All working must be clearly shown where necessary.
- Mathematical tables and silent electronic calculators may be used.
- This paper consists of **6** printed pages. Ensure that the question paper has all the pages and no questions are missing.

FOR EXAMINER'S USE ONLY:

QUESTION	MAXIMUM SCORE	CANDIDATES SCORE
1	19	
2	12	
3	09	
TOTAL SCORE	40	

1. You are provided with
- **Solution A**, a saturated solution of sodium ethanedioate, $Na_2C_2O_4$ (sodium oxalate).
- **Solution B**, aqueous potassium manganate (VII).
- **Solution C**, 0.1M ammonium iron (II) sulphate.
- 1M sulphuric (VI) acid.

You are required to:
(a) Standardize **solution B** using **solution C**.
(b) Determine the **solubility of A** at room temperature.

Procedure I
Fill the burette with **solution B**.
Pipette 25cm³ of **solution C** into a conical flask and add 5cm³ of 1M sulphuric (VI) acid using a measuring cylinder.
Titrate **solution C** using **solution B** until a **permanent pale pink** colour **just** appears.
Repeat the procedure and complete **table A** below.

Table A	I	II	III
Final burette reading (cm³)			
Initial burette reading (cm³)			
Volume of B used (cm³)			

(4mks)

(a) Calculate the average volume of solution B used. (1mk)

(b) The reaction between manganate (VI) and iron (II) ions is shown by the ionic equation.

$$MnO_{4(aq)}^{-} + 5Fe_{(aq)}^{2+} + 8H_{(aq)}^{+} \rightarrow Mn_{(aq)}^{2+} + 5Fe_{(aq)}^{3+} + 3H_2O_{(l)}$$

(i) Calculate the number of moles of C used. (1mk)

(ii) Calculate the number of moles of B used. (1mk)

(iii) Calculate the number of moles of B per litre. (1mk)

Procedure II

Measure the temperature of **solution A** and record it in the space provided below.
Using a measuring cylinder, measure **2cm³ of solution A** into a conical flask and **dilute** it by adding 75cm³ of distilled water. **Label this solution D**.
Fill the burette with **solution B**. Using pipette filler pipette 25cm³ of solution D into a conical flask and add 5cm³ of **1M sulphuric acid** using a measuring cylinder.
Heat the solution to about 60°C and titrate while still hot with B until a **permanent pink colour just** appears. Record your results in the **table B** below. **Repeat** this procedure to complete the table.

Temperature of solution A _____ °C.

Table B	I	II	III
Final burette reading (cm³)			
Initial burette reading (cm³)			
Volume of B used (cm³)			

(4mks)

(c) (i) Calculate the average volume of B used. (1mk)

The reaction between manganate (VII) ions and ethanedioate ions is given by the ionic equation below.

$$2MnO_{4(aq)}^{-} + 5C_2O_{4(aq)}^{2-} + 16H_{(aq)}^{+} \rightarrow 2Mn_{(aq)}^{2+} + 10CO_{2(g)} + 8H_2O_{(l)}$$

(ii) Calculate the number of moles of manganate (VII) ions in average volume of B used. (1mk)

(iii) Calculate the number of moles of ethandioate ions in 25cm³ of solution D. (1mk)

(iv) Calculate the number of moles of ethandioate ions in 100cm³ of solution D. (1mk)

(v) How many moles of ethandioate ions are in 25cm³ of solution A used? (1mk)

(vi) Given that the molecular formula of sodium ethandioate is $Na_2C_2O_4$, calculate its solubility in grams per 100g of water at room temperature (Na = 23, C = 12, O = 16). (Assume the density of solution is 1g/cm³). (2mks)

2. You are provided with **solid G**. Carry out the tests below. Write your observations and inferences in the spaces provided.

(a) Place about **half** of solid G in a clean dry test tube and heat it strongly.

Observation	Inference
(1mk)	(1mk)

(b) Place the **remaining** solid G in a boiling tube. Add **10cm³** of distilled water. Shake the mixture for 1 minute. **Filter** the mixture.

Observation	Inference
(1mk)	(1mk)

(i) **Dip** blue and red litmus papers into the filtrate.

Observation	Inference
(1mk)	(1mk)

(ii) To about 2cm³ of **filtrate**, add 3 drops of **dilute hydrochloric acid**.

Observation	Inference
(1mk)	(1mk)

(iii) To about 2cm³ of **filtrate**, add drops of 2M sulphuric (VI) acid.

Observation	Inference
(1mk)	(1mk)

(iv) To about 1cm³ of filtrate, add 5cm³ of dilute sodium hydroxide **(excess)**.

Observation	Inference
(1mk)	(1mk)

3. You are provided with **liquid F**. Carry out the tests below and write your observations and Inferences in the spaces provided.

(a) Place **one drop** of liquid F on a metallic spatula and **burn** it using a Bunsen burner.

Observation	Inference
(1mk)	(1mk)

(b) Place about 2cm³ of the **remaining** liquid F in a test tube. Add 3cm³ of distilled water and shake the mixture well.

Observation	Inference
(½mk)	(½mk)

(c) (i) To about 2cm³ of the remaining liquid F, add **a small amount** of sodium hydrogen carbonate.

Observation	Inference
(1mk)	(1mk)

(ii) To about 1cm³ of liquid F, add 1cm³ of **acidified potassium dichromate (VI)**.

Observation	Inference
(1mk)	(1mk)

(iii) To about 2cm³ of the mixture, add two drops of **bromine water**.

Observation	Inference
(1mk)	(1mk)

CENTRAL KENYA NATIONAL SCHOOLS JOINT EXAMINATION 2014
233/3 CHEMISTRY PAPER 3 - MARKING SCHEME

TABLE A

1. (a) Complete table – 1 mark
Decimal places – 1 mark (must be used consistently)
Accuracy – 1 mark $\begin{pmatrix} \pm\ 0.1\ of\ \ school\ value - 1\ mark \\ \pm\ 0.2\ of\ \ school\ value - ½\ mark \end{pmatrix}$
Principles of averaging – 1 mark $\begin{pmatrix} Volumes\ averaged\ should\ be\ within\ a\ range \\ of\ \ 0.2\ of\ each\ other \end{pmatrix}$
Final accuracy – 1 mark $\begin{pmatrix} Average\ value\ within \pm\ 0.1\ of\ \ S.V - 1\ mark \\ Average\ value\ within \pm\ 0.2\ of\ \ S.V\ - ½\ mark \end{pmatrix}$

(b) (i) Moles of C used
$\frac{25 \times 0.1}{1000}$ ✓½ = 0.0025 ✓½

(ii) $\frac{1 \times 0.0025}{5}$ ✓½ = 0.0005 ✓½

(iii) $\frac{0.0005 \times 1000}{Average\ volume\ of\ \ B}$ ✓½ = ans ✓½

TABLE B

Marking is as per table A above.

(c) (ii) $\frac{Average\ volume \times 0.02}{1000}$ ✓½ = ans ✓½ c(ii)

(iii) $\frac{Ans\ \ c(ii) \times 5}{2}$ ✓½ = ans c(iii)

(iv) $\frac{Ans\ \ c(iii) \times 1000}{25}$ ✓½ = ans c(iv)

(v) Same as ans c(iv) ✓¹

(vi) Mass of 5salt = 1 × 25 = 25g
Mass of $Na_2C_2O_4$ = Ans (v) × RFM = Ans (A) ✓½
Mass of water (solvent) = 25g – Ans (A) = Ans (B) ✓½
Solubility $= \frac{Ans(A)}{Ans(B)} \times 100$ ✓½
= Final Ans ✓½

2. (a)

Observation	Inference
- Colourless liquid formed on cooler parts ✓½ - White residue ✓½ Accept: Colourless vapour condense on cooler upper part of the test tube. Reject: Liquid condensing.	- Hydrated solid ✓½ (tied to idea of condensation) - OH^- ✓½

(b) (i)

Observation	Inference
- Colourless filtrate ✓½ - White residue ✓½	- Sparingly soluble ✓¹

(ii)

Observation	Inference
- Red litmus turns blue ✓½ - Colour of blue litmus remains/persists ✓½	- OH^-, HCO_3^-, CO_3^{2-} **NB**: 3 ions ✓¹ 2 ions ✓½ 1 ion – 0mk

(iii)

Observation	Inference
- No effervescence ✓½ - No white ppt ✓½	- OH^- present ✓½ - Pb^{2+} absent ✓½

(iv)

Observation	Inference
- White ppt ✓¹	- Ca^{2+} ✓½ Ba^{2+} ✓½

(v)

Observation	Inference
- No white ppt ✓¹ Accept: - White ppt dissolves Reject: White ppt insoluble	- Ba^{2+} ✓¹

3. (a)

Observation	Inference
- Burns with a yellow sooty or smoky flame ✓¹	 , Present Accept: Unsaturated organic cpd - Long chain hydrocarbon

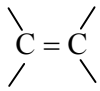
(b)

Observation	Inference
Immiscible/form 2 layers ✓½	- Non-polar compound ✓½

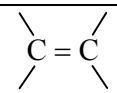
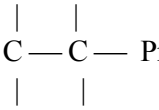
(c) (i)

Observation	Inference
- No effervescence/bubbling/fizzing ✓¹ - White residue ✓½ Rej: Fizzling/hissing	- H+/RCOOH absent✓¹

(ii)

Observation	Inference
Acidified $K_2Cr_2O_7$ remains orange ✓¹ Accept: Acidified dichromate (VI) did not change from orange to green. Reject: Yellow colour for dichromate	- R – OH assent ✓¹ Ignore  , Indicated as absent

(iii)

Observation	Inference
Bromine water remains orange/yellow//Bromine water not decolourised. ✓¹	 , Absent Accept:  Present