S-R.

Name....SSEKITTO RICHARD........................Centre/Index No.........................

School.KAJAMBYA PARENTS' SEC. SCHOOL Signature....Schining.........

545/3
CHEMISTRY
(PRACTICAL)
Paper 3
July/August
2hours

WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Certificate of Education

CHEMISTRY PRACTICAL

Paper 3
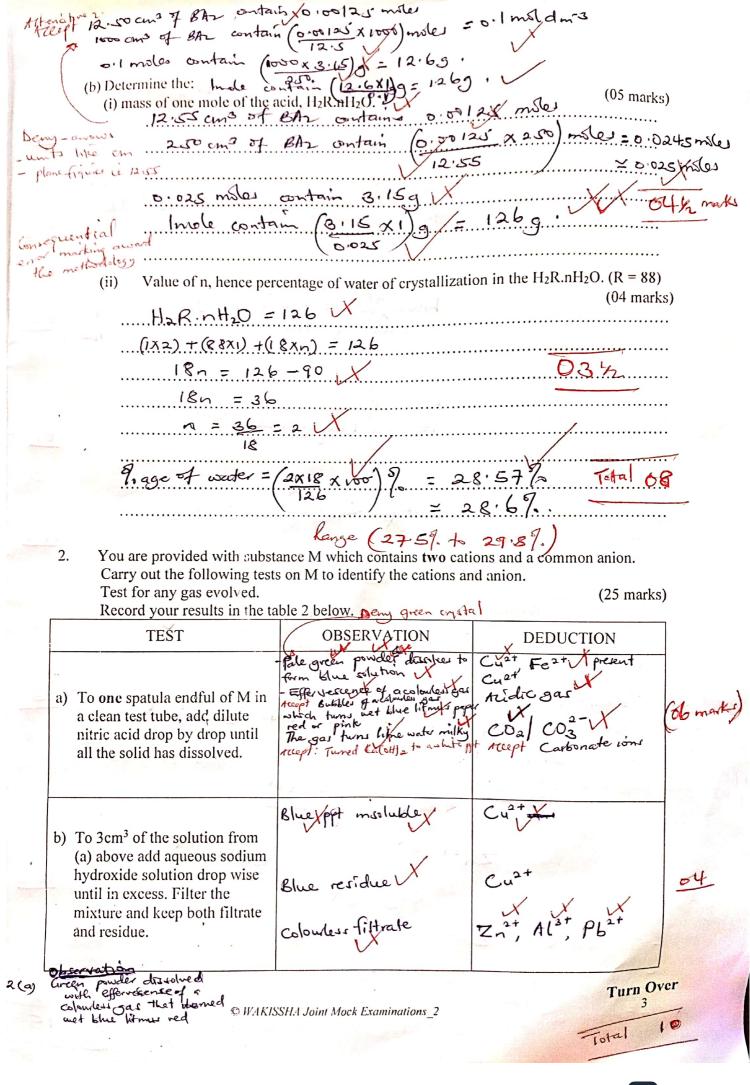
2hours

INSTRUCTIONS TO CANDIDATES.

- *Answer **both** questions. All answers must be written in the spaces provided.*

- *You are **not** allowed to use any reference books (i.e text books or handouts on qualitative analysis etc).*

- ***All working must be clearly shown.***

- *Mathematical tables and silent non-programmable scientific calculators may be used.*

For Examiner's use only		
Q.1	Q.2	Total

Turn Over

1. You are provided with solutions **BA1** and **BA2**.
   BA1 was prepared by dissolving 1.0g of sodium hydroxide to make 250cm³ of solution while
   BA2 is a solution containing 3.15g of acid $H_2R.n\ H_2O$ per 250cm³ of solution.
   You are required to determine the percentage of water of crystillisation. n, in the acid
   $H_2R.nH_2O$.

   Exact f^{-k} ± 0.1
   ± 0.2 ✓

Procedure
Transfer 20/25 cm³ of **BA1** into a clean conical flask using a clean pipette. Add 3 drops of
phenolphthalein indicator to the contents of the flask then titrate with **BA2** from the burette.

Repeat the titration to obtain at least 3 consistent results.

on Average { ± 0.3 ✓✓
± 0.4 ✓
0½ Volume { ± 0.5 ✗
> 0.5 No score

Record your results in the table 1 below.

Volume of pipette used = ...**25.0** ✓...... cm³ *(1 mark)*

Award ½ mark if recorded to 1 dp
0 if any rounded to zero dp

Award a mark if the final is greater than the initial BR

	1	2	3
Final Burette reading (cm³)	25.30 ✓	37.70 ✓	17.50 ✓
Initial Burette reading (cm³)	12.70 ✓	25.30 ✓	5.00 ✓
Volume of BA2 used (cm³)	12.60 ✗	12.40 ✓	12.50

(4½ marks) 7½

Best values should not exceed 0.2
Not score
12.03, 12.05
14.07 ✗

Values for calculating average volume of BA2 used;....**12.60** ✗...;...... and ..**12.50** ✓.... *(3 marks)* *(1 mark)*

Average volume of BA2 used = ...**12.60 + 12.50** ✓......
                                                  2   *(02 marks)*

± 0.1 ✓✓
± 0.2 ✓
± 0.3 ✓✓
± 0.4 ✓✓
> 0.5 Ignore

= **12.55 cm³** ✗✓ *(02½)*

(a) Calculate the number of moles of:

(i) BA1 used: *Accept RFm; reject if units indicated on the answer ie 40g.* *(03 marks)*

Molar mass of $NaOH = (23 \times 1) + (16 \times 1) + (1 \times 1) = 40g$ ✗

40g contains 1mole

Accept or 1g of BA1 contain ($\frac{1}{40} \times 1$) mole

∴ 250cm³ of BA1 contains $\left(\frac{1}{40} \times 1\right)$ moles ✗ *(03 marks)*

= 0.025 moles

25.0cm³ of BA1 contain $\left(\frac{0.025 \times 25.0}{250}\right)$ moles

= 0.0025 moles

(ii) BA2 that reacted with BA1 *(02½ marks)*

$2NaOH_{(aq)} + H_2R_{(aq)} \longrightarrow Na_2R_{(aq)} + 2H_2O_{(l)}$ ✓

2 moles of BA1 react with 1 mole of BA2 ✓

∴ 0.0025 moles of BA1 react with $\left(\frac{1}{2} \times 0.0025\right)$ moles of BA2

= 0.00125 moles

(02½)

Alternatively
OR

a(i) 250cm³ of BA1 contain 1g of NaOH ✗

1000 cm³ of BA1 contain $\left(\frac{1}{250} \times 1000\right)$g of NaOH = 4g

Molar mass of NaOH $= (23 \times 1) + (16 \times 1)(1 \times 1) = 40g$ ✓✗

40g of NaOH contain 1mole

4g of NaOH contain $\left(\frac{1}{40} \times 4\right)$ moles = 0.1 M ✓

1000 cm³ of BA1 contain 0.1 moles

.... contain $\frac{0.1}{1000} \times 25.0$ moles = 0.0025 moles

Total 17 marks

12.50 cm³ of BA₂ contains 0.00125 moles = 0.1 mol dm⁻³

1000 cm³ of BA₂ contain $\left(\frac{0.00125 \times 1000}{12.5}\right)$ moles = 0.1 mol dm⁻³

0.1 moles contain $(1000 \times 3.15)g = 12.69$

(b) Determine the: 1 mole contain $\left(\frac{12.6 \times 1}{0.1}\right)g = 126g$

(i) mass of one mole of the acid, $H_2R.nH_2O$.

(05 marks)

12.55 cm³ of BA₂ contains 0.00125 moles

2.50 cm³ of BA₂ contain $\left(\frac{0.00125 \times 250}{12.55}\right)$ moles = 0.0245 moles ≈ 0.025 moles

Deny - answers
- units like cm
- place figures ie 12.55

0.025 moles contain 3.15g

1 mole contain $\left(\frac{3.15 \times 1}{0.025}\right)g = 126g$

04½ marks

Consequential marking award error the methodology

(ii) Value of n, hence percentage of water of crystallization in the $H_2R.nH_2O$. (R = 88)

(04 marks)

$H_2R.nH_2O = 126$

$(1 \times 2) + (88 \times 1) + (18 \times n) = 126$

$18n = 126 - 90$

03½

$18n = 36$

$n = \frac{36}{18} = 2$

% age of water $= \left(\frac{2 \times 18}{126} \times 100\right)\% = 28.57\%$ Total 08

$\approx 28.6\%$

range (27.5% to 29.8%)

2. You are provided with substance M which contains **two** cations and a common anion.
    Carry out the following tests on M to identify the cations and anion.
    Test for any gas evolved.   **(25 marks)**
    Record your results in the table 2 below. Deny green crystal

TEST	OBSERVATION	DEDUCTION
a) To **one** spatula endful of M in a clean test tube, add dilute nitric acid drop by drop until all the solid has dissolved.	- Pale green powder dissolves to form blue solution - Effervescence of a colourless gas, Accept Bubbles of colourless gas which turns wet blue litmus paper red or pink. The gas turns lime water milky. Accept: Turned Ca(OH)₂ to a white ppt	Cu^{2+} Fe^{2+} present Cu²⁺ Acidic gas CO_2 / CO_3^{2-} Accept Carbonate ions (06 marks)
b) To 3cm³ of the solution from (a) above add aqueous sodium hydroxide solution drop wise until in excess. Filter the mixture and keep both filtrate and residue.	Blue ppt insoluble Blue residue Colourless filtrate	Cu^{2+} Cu^{2+} $Zn^{2+}, Al^{3+}, Pb^{2+}$ 04

2(a) Observation
Green powder dissolved with effervescence of a colourless gas that turned wet blue litmus red

Turn Over
3

Total 10

c) To the filtrate from (b) add dilute nitric acid drop wise until the solution is just acidic. Divide the resultant solution into two equal portions.	White ppt dissolves to form a colourless solution ✓	Zn^{2+}, Al^{3+}, Pb^{2+} ✗ ✗ ✗	03
(i) To the **first** potion from (c) above add aqueous sodium hydroxide solution drop wise until in excess.	White ppt dissolves to form a colourless solution ✗ ✗	Zn^{2+}, Al^{3+}, Pb^{2+} ✗ ✓ ✗	03
(ii) To the **second** portion add aqueous ammonia solution drop wise until in excess	White ppt ^soluble forming a colourless solution ✗ ✗ Accept dissolves	Zn^{2+} ✗ Confirmed Accept without the word confirmed	02
(d) To the residue from (b), put in a clean test tube, add dilute nitric acid drop by drop as you shake until the solid just dissolves.	Blue residue dissolves to form blue solution ✗	Cu^{2+} ✗	01
(i) To 1 cm³ of the resultant solution from (d) above, add aqueous sodium hydroxide solution until in excess.	Blue ppt insoluble ✗ ✗	Cu^{2+} ✗	01½
(ii) Use 1cm³ of the resultant solution from (d) above to carry out a test of your own choice to confirm one of the cations in M. Actual Deny if test incomplete To 1cm³ of the resultant solution, add aqueous ammonia drop wise until in excess ✗	Actual Deny if incomplete Award if alternar states Blue ppt soluble Blue ppt soluble. forming a deep blue solution ✗ ✗ ✓ Brown precipitate ✗ ✗ Accept-White ppt, ffaint brown solution	Actual ✓ Cu^{2+} ✓ confirmed Accept without the word confirmed.	03

Accept ✗
Add aq NH₃ drop wise until in excess ✗

Accept
Add 2 drops of KI solution ✓

(e) Identify the

(i) Cations : ....Zn^{2+} ✗............ and ....Cu^{2+} ✓............ (1 mark) 01½

(ii) Anion ....CO_3^{2-} ✗............ (½ mark)

- To score for Zn^{2+} it should have confirmed in c(ii)
- " " for Cu^{2+} " " Identified in d(i) and confirmed it in d(ii)
- Emphasis on Correct symbols of Cations and Anions

END

Total 15

4