Name....WAKISSHA PROPOSED GUIDE.....Centre/Index No...Kosh.....

School...0772244944/0758891802..... Signature.....

545/3
CHEMISTRY
(PRACTICAL)
Paper 3
July/August 2023
2 hours

WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Certificate of Education

CHEMISTRY PRACTICAL

Paper 3

2 hours

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**
25	25	50

1. You are provided with the following:

BA1, which is a solution containing 20.0 g/dm^3 of unknown hydrated salt, $RCO_3.xH_2O$.

BA2, which is a 0.2 M hydrochloric acid.

You are required to determine the number of Moles of water of crystallization, x, in $RCO_3.xH_2O$ and the percentage of the anhydrous salt, RCO_3.
(1 mole of hydrated salt reacts with 2 moles of hydrochloric acid)

Procedure

Pipette 25.0 cm^3 (or 20.0 cm^3) of **BA1** into a clean conical flask using a clean pipette. Add 2-3 drops of Methyl orange indicator and titrate it with **BA2** from the burette.

Repeat the procedure above until you obtain consistent results.

Record your results in the table below.

Results;

Volume of pipette used = ... 25.0 ✓ (cm^3) 0½ (½mark)

	1	2	3
Final Burette reading (cm^3)	21.10 ✓	31.00 ✓	21.00 ✓
Initial Burette reading (cm^3)	0.00 ✓	10.00 ✓	0.00 ✓
Volume of **BA2** used (cm^3)	21.10 ✗	21.00 ✓ ✗	21.00 ✓ ✗

07½

(7½ marks)

Titre values of **BA2** used to calculate the average volume.

..... 21.00 and 21.00 cm^3 ✓ ✓ 01½ .....

..... (cm^3) (½mark)

Average volume of **BA2** used.

..... $\frac{21.00 + 21.00}{2}$ ✓ = $\frac{42.00}{2}$ ✓ = 21.00 cm^3 ✓ 02½ .....

..... ±0.1 cm^3; 2½ ±0.2 cm^3; 2 ±0.3 cm^3; 1½ ±0.4 cm^3; 1 ±0.5 cm^3; ½ (cm^3) (2½mark)

(a) Calculate;

(i) the number of moles of **BA2** that reacted. (03 marks)

1000 cm^3 of BA2 contain 0.2 moles

1 cm^3 of BA2 contain $\left(\frac{0.2}{1000}\right)$ moles ✓

03

21.00 cm^3 of BA2 contain $\left(\frac{0.2 \times 21.00}{1000}\right)$ moles

= 0.0042 moles of BA2 ✓

(ii) the concentration of the hydrated salt, $RCO_3.xH_2O$, in Moles per dm^3. (03 marks)

2 moles of HCl react with 1 mole of hydrated salt
1 mole of HCl react with $(\frac{1}{2})$ moles of hydrated salt
0.0042 moles of HCl react with $(\frac{1}{2} \times 0.0042)$ moles
$= 0.0021$ moles

$25\,cm^3$ of BA1 contain 0.0021 moles
$1\,cm^3$ of BA1 contain $(\frac{0.0021}{25})$
$1000\,cm^3$ of BA1 contain $(\frac{0.0021 \times 1000}{25})$
$= 0.084$ moles per dm^3.

03

(iii) the relative formula mass of the dehydrated salt, $RCO_3.xH_2O$. (03 marks)

0.084 moles of salt weigh 20g
1 mole of hydrated salt weighs $(\frac{20}{0.084})$ g
$= 238.0952$ g
Relative formula mass $\simeq 238$

03

(b) Determine the;

(i) the value of x, in $RCO_3.xH_2O$. (02 marks)
[R = 46, O = 16, C = 12, H = 1]

$RCO_3.xH_2O = 238$
$46 + 12 + (3 \times 16) + 18x = 238$
$106 + 18x = 238$
$x = \frac{238 - 106}{18} = 7.333$
$x \simeq 7$

02

(ii) the percentage of the anhydrous salt RCO_3. (03 marks)

% of anhydrous salt $= \frac{\text{Mass of anhydrous salt}}{\text{Relative formula mass}} \times 100$
$= \frac{106}{238} \times 100$
$= 44.54\%$

03

You are provided with substance **Q** which contains **two** cations and a common anion.
Carry out the following tests on **Q** to identify the cations and anion present. Identify any gas(es) evolved.
Record your observations and deductions in the table below. (23½ marks)

TEST	OBSERVATION	DEDUCTION
(a) To **one** spatula endful of Q in a clean test tube, add 4 cm^3 of distilled water and shake well. Filter and keep both the filtrate and residue. Divide the filtrate into **three** equal portions. (1 cm^3 each)	White powder partially dissolves Colourless filtrate White residue	Mg^{2+}, Ca^{2+}, Pb^{2+}, NH_4^+, Al^{3+}, Zn^{2+} any two correct

02½

Turn Over

(i) To the first portion add aqueous ammonia drop wise until in excess.	No observable change	NH_4^+, Ca^{2+} present	01½
(ii) To the **second** portion add aqueous sodium hydroxide drop wise until in excess and warm.	Colourless gas with a chocking smell which turns moist red litmus paper blue and forms dense with fumes with conc. HCl	NH_3 gas evolved NH_4^+ confirmed present.	02½
(iii) To the remaining portion of the filtrate, add 3 drops of Lead (II) nitrate solution followed by dilute nitric acid solution drop by drop until in excess.	White precipitate which dissolves with effervescence of a colourless gas that turns moist ~~red~~ blue litmus red and lime water milky.	CO_2 gas formed CO_3^{2-} present	03
(b) Add dilute Nitric acid to the residue until it dissolves. Divide the resultant solution into **four** equal portions.	White solid dissolves with effervescence of a colourless gas which turns moist blue litmus red and lime water milky forming a colourless solution.	CO_2 gas CO_3^{2-} confirmed present Pb^{2+}, Mg^{2+}, Zn^{2+}, Ca^{2+}, Al^{3+}	05
(i) To the **first** portion add aqueous sodium hydroxide drop wise until in excess.	White precipitate which dissolves in excess forming 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 precipitate insoluble in excess.	Al^{3+}, Pb^{2+}	02
(iii) To the **third** portion add 3 drops of dilute hydrochloric acid solution. Warm the mixture, then allow to cool under water.	White precipitate which dissolves on warming and re-appears on cooling.	Pb^{2+} present	02
(iv) Use the **fourth** portion to carry out a test of your own choice to confirm the cation in the residue. TEST Add 3 drops of potassium iodide solution	Yellow precipitate is formed.	Pb^{2+} confirmed present.	02

(e) Identify the ions in Q;

(i) Cations : NH_4^+ and Pb^{2+} (01 mark)

(ii) Anion CO_3^{2-} (½ mark)

END