Marking Guide

AME .....

ANDOM/PERSONAL No. ...../..... SIGNATURE .....

545/3
CHEMISTRY PRACTICAL
Paper 3
Tuesday 1st August 2023 (Morning)
2 hours

ACHOLI SECONDARY SCHOOLS EXAMINATIONS COMMITTEE

Uganda Certificate of Education

Joint Mock Examinations, 2023

CHEMISTRY PRACTICAL

Paper 3

2 hours

STRUCTIONS TO CANDIDATES:

- ✓ Answer **both** questions. Answers are to be written in the spaces provided in this question paper only.
- ✓ All your work must be in blue or black ink. Any work done in pencil except drawings, will NOT be marked.
- ✓ You are NOT allowed to use any reference books (i.e. text books, booklets 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		
Questions	Marks	
1	25	
2	25	
Total	50	

Question 1:

You are provided with the following:

- **BA1** which is a solution made by dissolving 3.45g of a hydrated salt, R..nH_2O, in 250 cm^3 of water.
- **BA2** which is a 0.1M hydrochloric acid.

You are required to determine the value of n in the salt.

Procedure:

(i) Pipette 25.0 cm^3 (or 20.0 cm^3) of BA1 into a conical flask. Add 2 – 3 drops of methyl orange indicator and titrate with BA2 from the burette.

(ii) Repeat the titration until you obtain consistent results.

(iii) Record your results in the table below.

Table of Results:

Volume of the pipette used: ~~20~~ 25.0 cm^3 ✓ at to 1dp (½ mark) ½

~~to two dp~~

- Do not accept: - FBR, IBR 1dp ✓ - Range vol BA2 ± 5 from centre - Wrong vol of BA2 -deny FBR - Wrong sub 0

Experiment Number / Titre Readings	1	2	3
Final burette reading (cm^3)	27.60 ✓	29.00 ✓	29.60 ✓
Initial burette reading (cm^3)	0.00 ✓	1.50 ✓	2.10 ✓
Volume of **BA2** used (cm^3)	27.60 ✓	27.50 ✓	27.50 ✓

7½

Values used to calculate average volume of **BA2** used are: from table 27.50 and 27.50 cm^3 ✓ ½ (7½ marks)

Dif 0.2 (01 mark)

Average volume of **BA2** used: $\frac{27.50 + 27.50}{2}$ = 27.50 cm^3 ±0.1-2½ (2½ marks)

±0.2 - 2
±0.3 - 1½
±0.4 - 1
±0.5 - ½

2½

Questions:

(a) Calculate the:-

(i) number of moles of hydrochloric acid that reacted. (2½ marks)

- Do not accept: ; = and :
- Deny wrong expression

1000 cm^3 of hydrochloric acid contain 0.1 moles ✓

1 cm^3 of hydrochloric acid contains $\frac{0.1}{1000} \times 1$ moles

∴ 27.50 cm^3 of hydrochloric acid contain $\frac{0.1}{1000} \times 1 \times 27.50$ ✓ 3

= 0.00275 moles ✓

to at least 4 dp

14

(ii) number of moles of $R.nH_2O$ that reacted (1 mole of $R.nH_2O$ reacts with 2 moles of hydrochloric acid) (02 marks)

2moles of hydrochloric acid react with 1 mole of $R.nH_2O$ ✓

1 mole of hydrochloric acid reacts with $\frac{1}{2}$ moles of $R.nH_2O$

0.00275 moles of acid react with $\frac{1}{2} \times 0.00275$ moles ✓

$= 0.001375$ moles ✓

~~up to~~ 4 dp at least

* Wrong answer – use subsequential marking. (award for method deny for answer)

2

(iii) number of moles of $R.nH_2O$ in 250 cm^3 of BA1. (03 marks)

25.0 cm^3 of BA1 contain 0.001375 moles of $R.nH_2O$ ✓

1 cm^3 of BA1 contains $\frac{0.001375}{25}$ moles

$\therefore$ 250 cm^3 of BA1 contain $\frac{0.001375}{25} \times 250$ moles ✓

$= 0.01375$ moles ✓

3

(b) Determine the value of n in $R.nH_2O$. [H = 1; O = 16; R = 106] (5½ marks)

0.01375 moles of $R.nH_2O$ weigh 3.45 ~~mole~~s g ✓

Accept 1mole of $R.nH_2O$ weighs $\frac{3.45 \times 1}{0.01375}$ g ✓

RFM = $\frac{3.45}{0.01375}$

$= 250.91$ g ✓

$\therefore$ RFM of $R.nH_2O = 250.91$

$106 + n(2+16) = 250.91$

$106 + 18n = 250.91$ ✓

$18n = 250.91 - 106$ ✓

$n = \frac{144.91}{18}$ ✓

$n = 8$ ✓

Range 6 to 11

6

11

25

Question 2:

You are provided with substance **K** which contains **two** cations and **one** anion. Carry out the following tests on K and identify the cations and the anion present in K. Identify any gas(es) that may be evolved. Record your observations and deductions in the table below: (25 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat one spatula end-full of K strongly in a dry test tube.	White condensate/liquid ✓ turned anhydrous copper (II) sulphate ~~from~~ white to blue ✓ Colourless gas ✓ turned acidified potassium dichromate from orange to green ✓ and blue litmus red ✓ Black residue ✓ White residue ✓	Hydrated salt/Water of crystallization ✓ SO_2 ✓ SO_4^{2-} or SO_3^{2-} ✓ ~~Cu~~ CuO ✓, Cu^{2+} ✓ ~~Al_2O_3~~, ~~MgO~~, CaO ; ~~Al^{3+}~~, ~~Mg^{2+}~~, Ca^{2+}
(b) Dissolve two spatula end-full of K in about 5 cm^3 of water and to the resultant solution, add dilute sodium hydroxide solution drop-wise until in excess and filter. Keep both the filtrate and the residue.	Blue solution Blue ~~ppt~~ insoluble in excess OR Blue residue ✓ Colourless ~~residue~~ filtrate ✓	Cu^{2+} ✓ Pb^{2+} ✓, Zn^{2+} ✓ Al^{3+}, ~~Mg^{2+}~~, ~~C~~ Any two
(c) To the filtrate, add dilute nitric acid until the solution is just acidic. Divide the acidified solution into five portions. (i) To the **first** portion of the acidified solution, add dilute sodium hydroxide solution drop-wise until in excess.	White ppt soluble in excess acid White ppt ✓ soluble ✓ in excess to form a colourless solution	Al^{3+} ✓✓, Pb^{2+} Zn^{2+} Any two.
(ii) To the **second** portion of the acidified solution, add aqueous ammonia drop-wise until in excess.	White ppt ✓ insoluble in excess	Al^{3+} ✓, Pb^{2+} ✓
(iii) To the **third** portion of the acidified solution, add 2 – 3 drops of potassium iodide solution. OR OR	No observable reaction No ~~yellow~~ ppt formed ✓ Solution remained colourless	Pb^{2+} absent ✓ Al^{3+} present ✓ Deduction must come from (c) (ii)

7 3 2 2 1½

13

25

TESTS	OBSERVATIONS	DEDUCTIONS
(iv) To the **fourth** portion of the acidified solution, add lead (II) nitrate solution and warm.	White ppt ✓ insoluble ✓ on warming	SO_4^{2-} ✓
(v) Use the **fifth** portion of the acidified solution to carry out a test of your own to confirm the anion in K. Test: Add drops of barium nitrate/chloride solution SO_4^{2-} must have been correctly identified ~~mentioned~~ in (a) and or (c) (v)	White ppt ✓ formed	SO_4^{2-} ✓
(d) Dissolve the residue in minimum amount of dilute sulphuric acid and divide the resultant solution into three parts. (i) To the **first** part of the solution, add sodium hydroxide solution drop-wise until in excess.	Blue solution Blue ppt ✓ insoluble ✓ in excess	Cu^{2+} ✓
(ii) To the **second** of the solution, add aqueous ammonia drop-wise until in excess	Blue ppt ✓ ~~soluble~~ to form a deep ~~b~~blue solution ✓ Solubility of ppt (blue) qualifies for deduction	Cu^{2+} ✓
(iii) To the third part of the solution, add zinc granules and leave to stand for 5 minutes.	Brown solid ~~formed~~ ✓ OR ~~B~~blue solution turns to colourless	Cu^{2+} ions ~~reduced~~ to $Cu_{(s)}$ ✓ OR Cu^{2+} ions displaced by zinc

Correctly identified confirmed ~~at least~~ ✓ ✓

(d) (i) The cations in **K** are Cu^{2+} ✓ (a), (d)(i)(ii) (iii) and Al^{3+} ✓ (c)(iii) ✓ 1½

(ii) The anion in **K** is SO_4^{2-} ✓ (a), (c)(v), (v) ✓

* Correct symbols, formula, charges

END

25

9½

  The End.