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545/3
CHEMISTRY
PRACTICAL
Paper 3
AUGUST, 2023
2 hours



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JINJA JOINT EXAMINATIONS BOARD

Uganda Certificate of Education

MOCK EXAMINATIONS – AUGUST, 2023

CHEMISTRY

PRACTICAL

Paper 3

2 hours

INSTRUCTIONS TO CANDIDATES:

- ☒ Answer All questions.
- ☒ Answers are to be written in the spaces provided.
- ☒ You are not allowed to use any reference books.
- ☒ All working must be clearly shown.
- ☒ Mathematical tables, slide rules and non-programmable silent electronic calculators may be used.
- ☒ [H=1, O=16]

For Examiner's use only

Q1	Q2	TOTAL
30	30	60
NH	NH	NH

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Turn Over

1. You are provided with the following;

BA1, which is a solution made by dissolving 6.0g of a mixture of sodium chloride and sodium hydroxide in 1 dm^3 of water.

BA2, which is a 0.05M solution of sulphuric acid.

You are required to determine the concentration of sodium hydroxide in g dm^{-3} and hence its percentage composition in BA1.

Procedure:

Pipette 20.0 or 25.0 cm^3 of BA1 into a clean conical flask, add 2-3 drops of phenolphthalein indicator and titrate the contents in the flask with BA2 from the burette until the end point. Repeat the titration 2-3 times until you obtain consistent results.

Record your results in the table below.

Table of results:

Volume of pipette used 25.0 cm^3

Award 01 mk (1 d.p.)
accept 0 d.p.

Final burette reading (cm^3)	<u>21.50</u>	<u>43.00</u>	<u>22.40</u>
Initial burette reading (cm^3)	<u>0.00</u>	<u>21.50</u>	<u>0.50</u>
Volume of BA2 used (cm^3)	<u>21.50</u>	<u>21.50</u>	<u>21.90</u>

Award 01 mk
for @ read
from burette
0.2 d.p.

Titre values used for calculating the average volume of BA2 used

21.50 21.50 cm^3

\therefore Average volume of BA2 used $= \frac{21.50 + 21.50}{2} = 21.50\text{ cm}^3$

Questions:

(a) Calculate the

(i) Number of moles of sulphuric acid in BA2 that reacted.

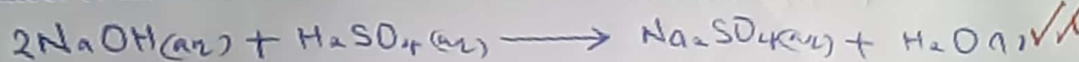
1000 cm^3 of BA2 contain 0.05 moles

21.50 cm^3 of BA2 contains $\frac{0.05 \times 21.50}{1000} = 0.001075\text{ moles}$

0.001075 moles

(2 d.p.) 0.3

- (ii) Number of moles of sodium hydroxide in BA1 that reacted



From equation;
1 mole of H_2SO_4 in BA2 reacted with 2 moles of NaOH in BA1, \checkmark

$$0.001075 \text{ moles } \text{H}_2\text{SO}_4 \text{ reacts with } \frac{2 \times 0.001075}{1} = 0.00215 \text{ moles} \quad \checkmark$$

- (iii) Molarity of sodium hydroxide in BA1

$$\begin{aligned} 25.0 \text{ cm}^3 \text{ of NaOH in BA1 contain } 0.00215 \text{ moles} \\ 1000 \text{ cm}^3 \text{ of NaOH in BA1 contains } \left(\frac{0.00215 \times 1000}{25.0} \right) \text{ moles} \end{aligned}$$

$$0.086 \text{ moles per litre} \quad \checkmark$$

- (b) Determine the:

- (i) Concentration of sodium hydroxide in BA1 in gdm⁻³

$$(\text{Na} = 23, \text{O} = 16, \text{H} = 1)$$

$$\text{molar mass NaOH} = (23 \times 1) + (1 \times 16) + (1 \times 1) = 40 \text{ g} \quad \checkmark$$

$$\begin{aligned} 1 \text{ mole of NaOH weighs } 40 \text{ g} \quad \checkmark \\ 0.086 \text{ moles NaOH weighs } \left(\frac{40 \times 0.086}{1} \right) \text{ g} \\ 3.44 \text{ g l}^{-1} \quad \checkmark \end{aligned}$$

- (ii) Percentage composition of sodium hydroxide in the mixture.

$$\begin{aligned} \text{Percentage composition} &= \frac{\text{concentration of NaOH in gdm}^{-3}}{\text{concentration of mixture in gdm}^{-3}} \times 100\% \\ &= \frac{3.44}{6.0} \times 100\% \\ &= 57.33\% \quad \checkmark \end{aligned}$$

$$\approx 57.3\% \quad \checkmark$$

2. You are provided with substance R which contains two cations and one anion. You are required to identify the cations and anion in R. Carry out the following tests on R and record your observations and deductions in the table below. Where a gas(es) is evolved, it must be identified.

TEST	OBSERVATIONS	DEDUCTIONS
(a) Heat two spatula endfuls of R in a hard glass test tube, first gently and then strongly until there is no further change	Colourless condensate turned white and blue CuSO_4 blue colourless gas turned blue red white sublimate	Water of crystallization \therefore R is hydrated salt the gas is acidic; $\therefore \text{CO}_2, \text{SO}_2, \text{Cl}_2,$ $\text{NH}_4\text{Cl}, \text{AlCl}_3,$
(b) To two spatula endfuls of R in a boiling tube, add about 3cm^3 of water and shake vigorously to dissolve.	R is soluble forming colourless solution	R contains a soluble salt . 03 Pb^{2+} Al^{3+} Zn^{2+}
(c) To the resultant solution in (b), add dilute ammonia solution dropwise until in excess. Shake and Filter. Keep both the filtrate and the residue.	White ppt. Insoluble in excess Colourless filtrate white residue	Pb^{2+} Al^{3+} 05 Zn^{2+} Pb^{2+} Al^{3+} Zn^{2+}
(d) To the filtrate from (c), add dilute nitric acid dropwise until the solution is just acidic. Divide the acidic	No bubbles given out. colourless solution remains colourless solution.	No CO_2 given out $\therefore \text{CO}_3^{2-}$ absent Al^{3+} Zn^{2+} Pb^{2+} 12

filtrate into four portions. (i) To the first portion of the acidified filtrate, add sodium hydroxide solution dropwise until in excess.	white ppt soluble in excess to form a colourless solution	Pb^{2+} , Al^{3+} , Zn^{2+} 04
(ii) To the second portion of the acidified filtrate, add dilute ammonia solution dropwise until in excess.	white ppt soluble in excess forming colourless solution	Zn^{2+} confirmed present: 02
(iii) To the third portion of the acidified filtrate add 4-5 drops of lead(II) nitrate solution and heat gently.	white ppt soluble on heating but reappears on cooling	SO_4^{2-} absent Cl^- present. 2½
(iv) Use the fourth portion to carry out a test of your own choice to confirm the anion in R. Record Test and observations. (v) Test: To a test solution added $Ba(NO_3)_2$ followed HNO_3	colourless solution remains colourless	SO_4^{2-} absent Cl^- confirmed present. 03
(e) Wash the residue and dissolve it in dilute sulphuric acid. Divide the acidic solution into three parts.	white residue dissolved in dilute H_2SO_4 forming a colourless solution.	Zn^{2+} , Pb^{2+} , Al^{3+} 2½
(i) To the first part of the acidic solution, add sodium hydroxide	white ppt soluble in excess forming a colourless solution.	Zn^{2+} , Pb^{2+} , Al^{3+} 2½

solution dropwise until in excess.		
(ii) To the second part of the acidic solution, add 3-4 drops of potassium iodide solution.	NO ppt formed ✓	Al^{3+} ✓ confirmed pre sent ✓ 01
(iii) To the third part of the acidic solution, add dilute ammonia solution dropwise until in excess	white ppt insoluble ✓ excess ✓	Al^{3+} ✓ H_2

(f) Identity the:

- (i) cations in R. Zn^{2+} ✓ and Al^{3+} ✓ H_2
- (ii) anion in R. Cl^- ✓

max, 30 marks