Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 4024/3

PAPER 3 Practical Test

SPECIMEN PAPER 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
As listed in Instructions to Supervisors
Mathematical tables and/or Electronic calculator

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **both** questions.
Write your answers in the spaces provided on the question paper.
You should show the essential steps in any calculation and record all experimental results in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
Qualitative analysis notes for this paper are printed on page 6.

FOR EXAMINER'S USE	
1	
2	
3	
TOTAL	

This question paper consists of 6 printed pages and 2 blank pages.

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1 You are required to determine the concentration of sodium hydroxide in g/dm^3 of solution using 0.1 $moldm^{-3}$ of nitric acid.

Solution **S** is 0.1 $moldm^{-3}$ nitric acid, $HNO_{3(aq)}$

Solution **R** is aqueous sodium hydroxide, $NaOH_{(aq)}$

Using a pipette, transfer 25 cm^3 of solution **R** into a conical flask.

Add 2 to 3 drops of phenolphthalein indicator.

Fill the burette with solution **S**.

Titrate solution **R** with **S**.

Repeat the titration as many times as you consider necessary to obtain accurate results.

(a) Record your results in **Table 1.1.**

Table 1.1

titration number	**1**	**2**	**3**	
final burette reading /cm^3				
initial burette reading /cm^3				
volume of acid used /cm^3				
tick the best results				

[15]

Summary

25.0 cm^3 of **R** required _____ cm^3 of **S**.

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(b) Write a balanced chemical equation for the reaction.

[1]

(c) Calculate

(i) the number of moles of HNO_3 that reacted with 25.0 cm^3 of NaOH,

[1]

(ii) the number of moles of NaOH in 25 cm^3,

[1]

(iii) concentration of NaOH in $moldm^{-3}$.

[1]

(d) Hence express the concentration of NaOH in g/dm^3
[M_r:NaOH = 40]

[1]
[Total:20]

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2 **(a)** You are required to investigate the effect of concentration on the rate of reaction between dilute nitric acid and sodium thiosulphate solution. The time taken for the quarry stone to become invisible will be noted

Experiment 1

Using a measuring cylinder, place 45 cm^3 of sodium thiosulphate solution in a conical flask. Place a quarry stone, the size of a pea, in the flask.

Add 5 cm^3 of 0.5 mol/dm^3 of nitric acid in the flask and at the same time start the stop watch.

Observe, from above, the time taken for the stone to become invisible.

(i) Record the time taken in **Table 2.1**

Experiment 2

Repeat experiment 1 using 30 cm^3 of sodium thiosulphate, 15 cm^3 of distilled water and 5 cm^3 of nitric acid,

Experiment 3

Repeat experiment 1 using 20 cm^3 of sodium thiosulphate, 25 cm^3 of distilled water and 5 cm^3 of nitric acid.

Table 2.1

experiment number	**volume of thiosulphate/ cm^3**	**volume of nitric acid/ cm^3**	**volume of distilled water/ cm^3**	**time/s**
1	45	5	0	
2	30	5	15	
3	20	5	25	

[3]

(ii) Draw a conclusion from the results in **Table 2.1.**

_____

_____ [2]

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(b) Solid **A** contains **one** cation and **one** anion.

Carry out the following tests on Solid **A** to identify the ions in **A**.

test	observations	deductions	
(i) Describe the appearance of Solid **A**.			[2]
(ii) Add a spatula of solid **A** to 10 cm^3 of distilled water in a boiling tube, stopper and shake.			[1]
(iii) Divide the solution from **(ii)** into two equal portions Use the portions for tests **1** and **2.**			
1. To the first portion, add aqueous sodium hydroxide. Warm the mixture.			[4]
2. To the second portion, add a few drops of nitric acid followed by silver nitrate solution. To the mixture add aqueous ammonia			[6]

(iv) Solid **A** contains _____ cation and _____ anion. [2]

[Total:20]

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QUALITATIVE ANALYSIS NOTES (4024/3)

Tests for anions

anion	test	test result
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
iodide (I^-) [in solution]	acidify with dilute nitric acid, then add aqueous lead (II) nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulphate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid then add aqueous barium nitrate.	white ppt.

Tests for aqueous cations

cation	effect of aqueous sodium hydroxide	effect of aqueous ammonia
aluminium (Al^{3+})	white ppt., soluble in excess colourless solution	white ppt., insoluble in excess giving a
ammonium (NH_4^+)	ammonia produced on warming	
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt.
copper (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron (II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron (III) (Fe^{3+})	red-brown ppt., insoluble in	red-brown ppt., insoluble in excess excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

Tests for gases

gas	**test and result**
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	"pops" with a lighted splint
oxygen (O_2)	relights a glowing splint
sulphur dioxide (SO_2)	turns aqueous potassium dichromate (VI) from orange to green

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