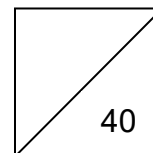




NORTH VISTA SECONDARY SCHOOL
Preliminary Examination 2025
Secondary 4 Express



CANDIDATE
NAME

CLASS

INDEX
NUMBER

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CHEMISTRY

Paper 3 Practical

6092/03

22 August 2025

1 hour 50 minutes

Candidates answer on the Question Paper

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Give details of the practical shift and laboratory where appropriate, in the boxes provided.
Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions in the spaces provided on the Question Paper.

The use of an approved calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.
Qualitative Analysis Notes are printed on page 12.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [] at the end of each question or part question.

Shift	
Laboratory	
For Examiner's Use	
1	
2	
3	
4	
Total	

- 1 You are provided with two solutions.

Solution **R** is 4.00 g/dm^3 sodium hydroxide.

Solution **S** is prepared by adding an unknown mass of magnesium oxide to 0.50 dm^3 of 0.100 mol/dm^3 of dilute sulfuric acid.

You are to determine the concentration of the acid remaining in **S**, by titrating **R** with **S** and to calculate the mass of magnesium oxide that has been added to the dilute sulfuric acid.

Read all the instructions below carefully before starting the experiment in Question 1.

Instructions

- (a) (i) Fill the burette with **S**.

Pipette 25.0 cm^3 of **R** into a conical flask. Add three drops of bromothymol blue indicator. Your solution should turn blue.

Add **S** from the burette to the flask until one drop just turns the solution permanently green.

Record your titration results in an appropriate format in the space provided. Repeat the titration as many times as you consider necessary to achieve consistent results.

Results

[5]

- (ii) From your titration value, obtain the average volume of **S** used.

Show clearly how you obtained this volume.

average volume of **S** used =[1]

- (b) (i) **R** is 4.00 g/dm³ of sodium hydroxide solution. Calculate its concentration in mol/dm³
[A_r of Na, 23; O, 16; H, 1].

concentrationmol/dm³ [1]

- (ii) Using your answer from (a)(ii), calculate the concentration of sulfuric acid in mol/dm³ that is present in solution **S**.

concentrationmol/dm³ [2]

- (iii) Initially, 0.50 dm³ of 0.100 mol/dm³ of dilute sulfuric acid was used to prepare solution **S**.
Using your answer in b(ii), calculate the number of moles of sulfuric acid that reacted with magnesium oxide.

.....mol [2]

- (iv) Using your answer in (iii), calculate the number of moles of magnesium oxide that has reacted with sulfuric acid.

.....mol [1]

- (v) Using your answer in (iv), calculate the mass, in grams, of magnesium oxide that has reacted with sulfuric acid [A_r of Mg, 24; O, 16].

.....g [2]

- (c) A student did the experiment without realising that there is a large air space in the pipette as she draws the solution **R** using the pipette.

Describe and explain the effect this would have on the calculation of the mass of magnesium oxide that has been added to sulfuric acid.

.....
.....
.....[2]

[Total: 16]

- 2 You are going to investigate the thermal stability of three metal carbonates. You are provided with three samples of metal carbonates, **W**, **X** and **Y** in boiling tubes.

Read all the instructions carefully before starting the experiments in Question 2.

Instructions

You are going to do three experiments.

Experiment 1

- Remove the stopper from the boiling tube labelled **W**.
- Use the balance to find the mass of the boiling tube and its contents. Record the mass in **Table 2.1**.
- Set up the experiment as shown in **Fig. 2.1**. Add about 3 cm depth of limewater in a clean test-tube.
- Heat the boiling tube gently and then strongly for 3 minutes.
- Record any other changes observed in **Table 2.1**.
- Remove the boiling tube from set-up and leave the boiling tube and its content to cool completely. Find the mass of the test-tube and its contents upon cooling and record in **Table 2.1**.
- You may continue with experiments 2 and 3 while waiting for the boiling tube to cool.

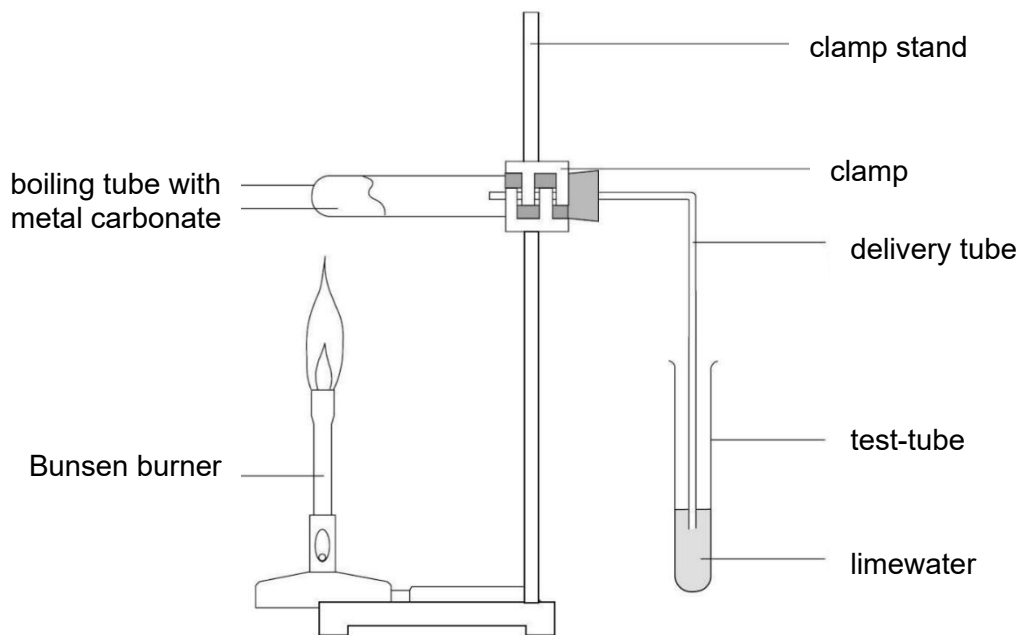


Fig. 2.1

Experiment 2

- Remove the stopper from the boiling tube labelled **X**.
- Repeat steps (b) to (f) from experiment 1.
- You may continue with experiment 3 while waiting for the boiling tube to cool.

Experiment 3

- Remove the stopper from the boiling tube labelled **Y**.
- Repeat steps (b) to (f) from experiment 1.

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- (a) Complete **Table 2.1**.

Table 2.1

metal carbonate	mass of boiling tube and contents before heating / g	mass of boiling tube and contents after heating / g	other observation(s)
W			
X			
Y			

[4]

- (b) Using the results in **Table 2.1**, arrange the thermal stability of the three metal carbonates from the most thermally stable to the least thermally stable. Explain your answer.

.....

[2]

- (c) A student mentioned that the change in mass recorded can be used to determine the amount of metal carbonate given in the boiling tube.

Explain whether you agree with the statement.

.....

[1]

- (d) A student found out that there is another way of bubbling gas into limewater. The method involves the use of a dropper pipette to draw the gas sample and insert into limewater.

Describe the disadvantage of using this method over the use of the delivery tube.

.....
[1]

- (e) You are provided with a sample of solution **A** containing the same cation found in metal carbonate **Y**.

Read all the instructions carefully before starting the experiments in Question 2e.

You should test and identify any gases evolved. The volumes given below are approximate and should be estimated rather than measured, unless otherwise stated.

Test	Procedure	Observation
1	Add about 2 cm depth of solution A into a clean test-tube. To this test-tube, add one piece of magnesium ribbon and leave it to stand for a few minutes. While waiting, continue with the rest of the tests below.	
2	Add about 1 cm depth of solution A into a clean test-tube. To this test-tube, add aqueous sodium hydroxide slowly with shaking until no further changes are seen.	
3	Add about 1 cm depth of solution A into a clean test-tube. To this test-tube, add two drops of aqueous ammonia slowly with shaking.	

[3]

- (f) Deduce the identity of metal carbonate **Y**. Justify your answer.

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.....[2]

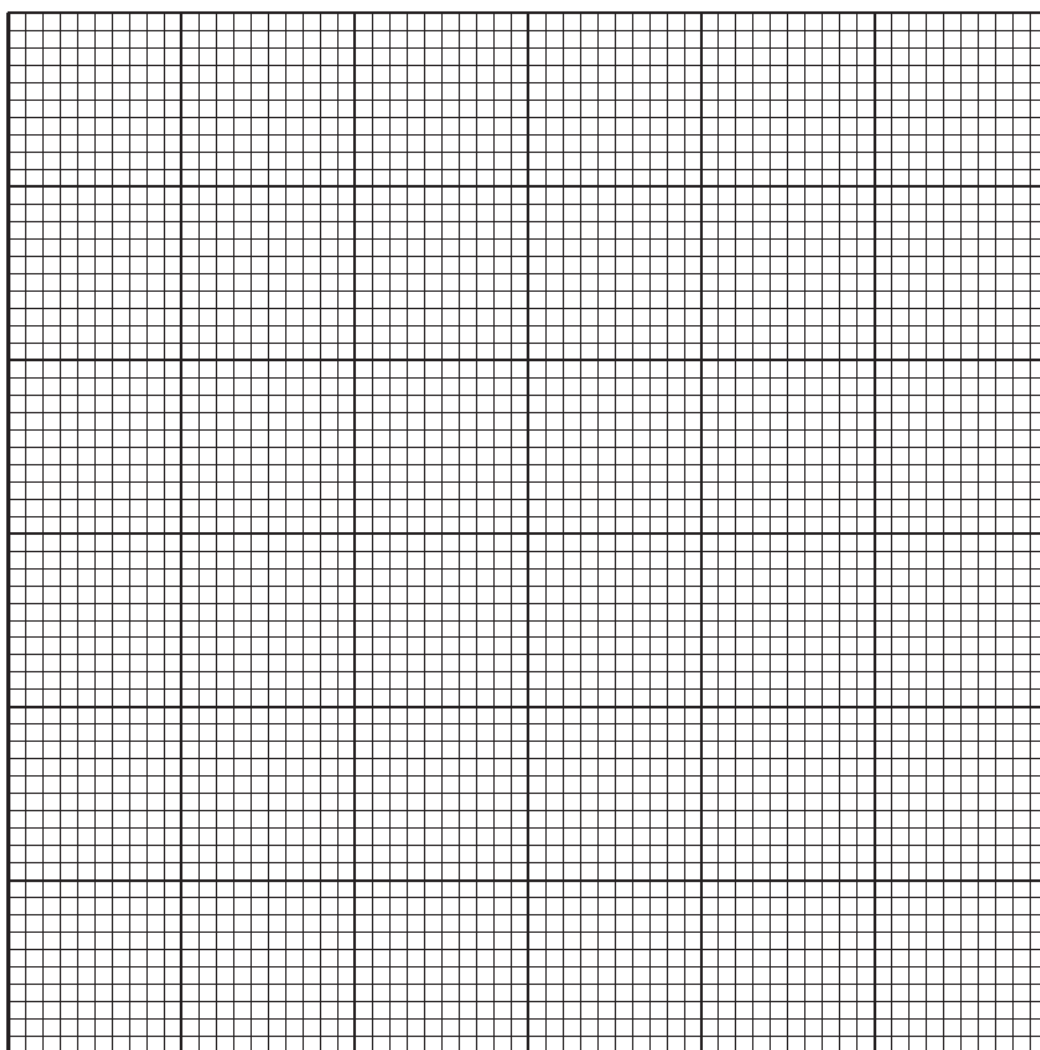
[Total: 13]

- 3 A student decides to investigate the rate of reaction for two metals **M** and **N** with an excess of an unknown acid. He added one piece of **M** and **N** each into separate conical flasks containing 50 cm³ of 0.100 mol/dm³ acid and measured the volume of hydrogen produced.

The student's results are given in the table.

metal	time taken / s	0	30	60	90	120	150	180	210
M	volume of H ₂ / cm ³	0	20	32	40	40	40	40	40
N	volume of H ₂ / cm ³	0	12	20	29	35	40	40	40

- (a) On the same axes, use the results given in the table to plot the graphs of volume of H₂ produced against time taken for **M** and **N** respectively. Draw lines of best fit. Label each graph clearly.



- (b) With reference to the graph, state and explain which experiment has a greater rate of reaction.

.....
.....
.....
.....[1]

- (c) Metals **M** and **N** both form ions with the same charge.
Use the data given to explain whether identical masses of **M** and **N** were used.

.....
.....
.....
.....[2]

[Total: 7]

- 4 Oxalic acid is a white solid which is soluble in both water and ethanol to form colourless solutions.

Outline an experiment to determine whether oxalic acid is more soluble in water or in ethanol, at room temperature.

Describe how you would use your results to determine whether oxalic acid is more soluble in water or ethanol, at room temperature.

You are provided with oxalic acid, water, ethanol and common laboratory apparatus.

You may include a labelled diagram in your answer.

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.....

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.....[4]

[Total: 4]

END OF PAPER

QUALITATIVE ANALYSIS NOTES

Tests for anions

<i>anion</i>	<i>test</i>	<i>test result</i>
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 silver nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

Tests for aqueous cations

<i>cation</i>	<i>effect of aqueous sodium hydroxide</i>	<i>effect of aqueous ammonia</i>
aluminium (Al^{3+})	white ppt., soluble in excess, giving a colourless solution	white ppt., insoluble in excess
ammonium (NH_4^+)	ammonia produced on warming	-
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt.
copper(II) (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 excess	red-brown ppt., insoluble in excess
lead(II) (Pb^{2+})	white ppt., soluble in excess, giving a colourless solution	white ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess, giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

[Lead(II) ions can be distinguished from aluminium ions by the insolubility of lead(II) chloride.]

Tests for gases

<i>gas</i>	<i>test and test result</i>
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	gives white ppt. with limewater (ppt. dissolves with excess CO_2)
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	“pops” with a lighted splint
oxygen (O_2)	relights a glowing splint
sulfur dioxide (SO_2)	turns aqueous acidified potassium manganate(VII) from purple to colourless

