Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education (9–1)

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8088897826

CHEMISTRY **0971/51**

Paper 5 Practical Test **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Notes for use in qualitative analysis are provided on pages 11 and 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.

For Examiner's Use	
Total	

This document consists of **11** printed pages, **1** blank page and **1** Insert.

CAMBRIDGE International Examinations

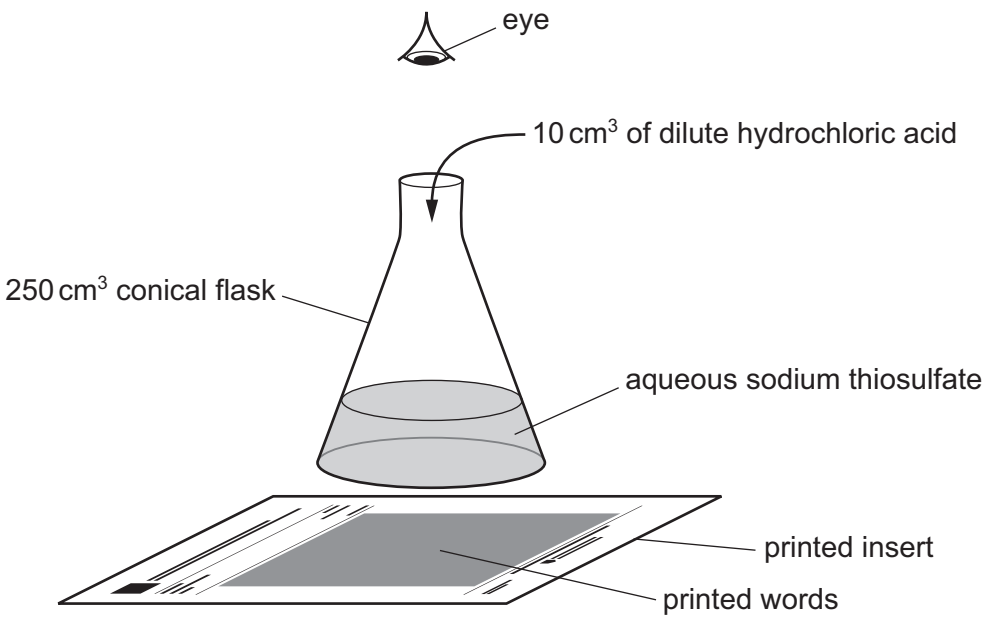
BLANK PAGE

1 You are going to investigate the rate of reaction between dilute hydrochloric acid and aqueous sodium thiosulfate. When these chemicals react they form a precipitate which makes the solution go cloudy. The formation of this precipitate can be used to show how fast the reaction proceeds.

Read all the instructions carefully before starting the experiments.

Instructions

You are going to do five experiments using the apparatus shown.



Experiment 1

- Use the large measuring cylinder to pour 50 cm^3 of aqueous sodium thiosulfate into the conical flask. Place the conical flask on the printed insert.
- Fill the small measuring cylinder with 10 cm^3 of dilute hydrochloric acid.
- Add the dilute hydrochloric acid to the solution in the conical flask. Start the timer immediately and swirl the mixture.
- View the conical flask from above and measure the time taken for the printed words to disappear from view. Record the time taken in the table on page 4.
- Immediately pour the contents of the conical flask into the quenching bath and rinse the conical flask with distilled water.

Experiment 2

- Use the large measuring cylinder to pour 40 cm^3 of aqueous sodium thiosulfate into the conical flask, followed by 10 cm^3 of distilled water. Place the conical flask on the printed insert.
- Fill the small measuring cylinder with 10 cm^3 of dilute hydrochloric acid.
- Add the dilute hydrochloric acid to the solution in the conical flask. Start the timer immediately and swirl the mixture.
- View the conical flask from above and measure the time taken for the printed words to disappear from view. Record the time taken in the table on page 4.
- Immediately pour the contents of the conical flask into the quenching bath and rinse the conical flask with distilled water.

[Turn over

Experiment 3

- Repeat Experiment 2 but use 35 cm^3 of aqueous sodium thiosulfate, 15 cm^3 of distilled water and 10 cm^3 of dilute hydrochloric acid.

Experiment 4

- Repeat Experiment 2 but use 30 cm^3 of aqueous sodium thiosulfate, 20 cm^3 of distilled water and 10 cm^3 of dilute hydrochloric acid.

Experiment 5

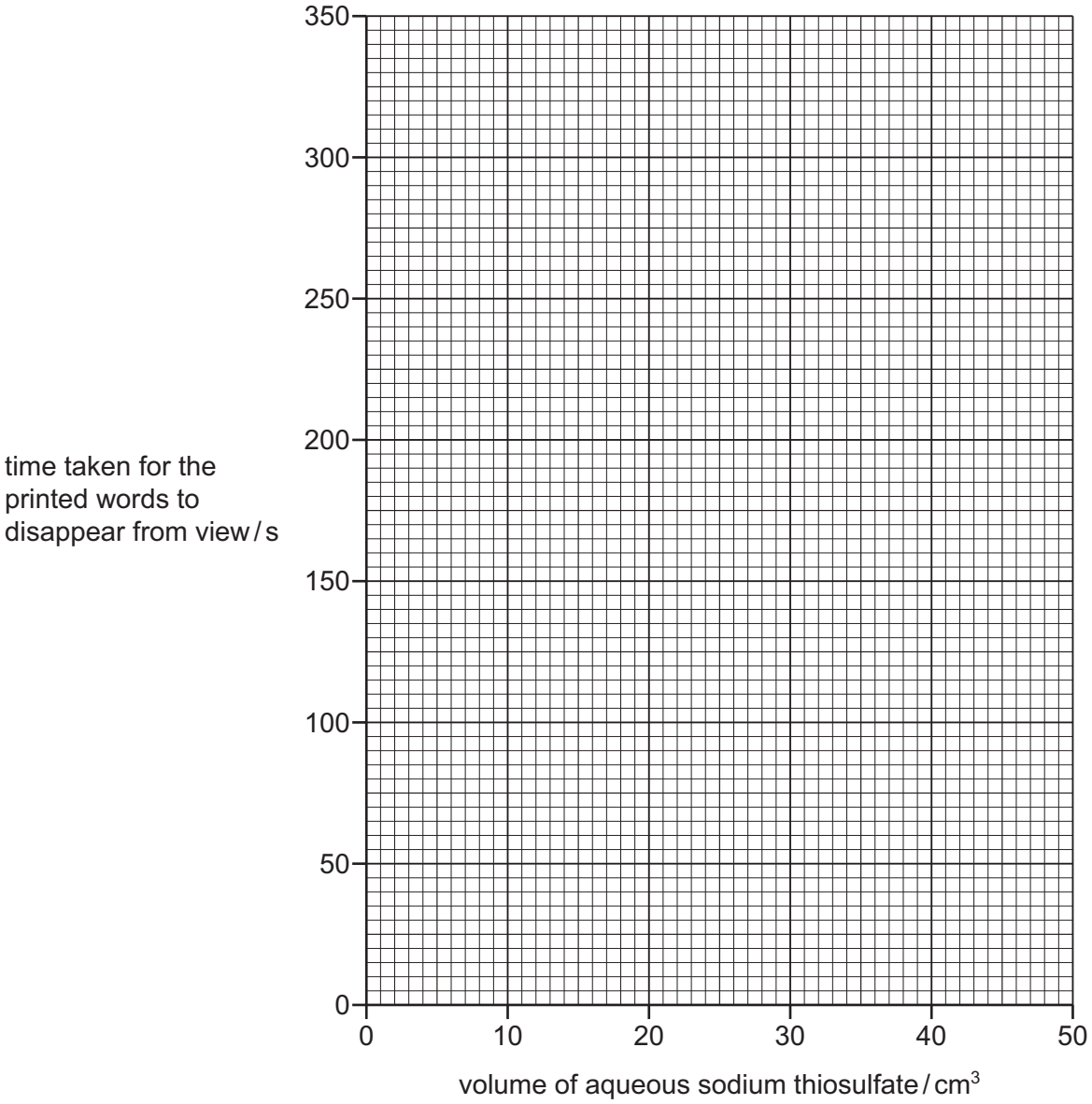
- Repeat Experiment 2 but use 10 cm^3 of aqueous sodium thiosulfate, 40 cm^3 of distilled water and 10 cm^3 of dilute hydrochloric acid.

(a) Complete the table.

experiment	volume of aqueous sodium thiosulfate / cm^3	volume of distilled water / cm^3	time taken for the printed words to disappear from view / s
1			
2			
3			
4			
5			

[3]

(b) Plot your results from Experiments 1–5 on the grid. Draw a smooth line graph.



[3]

(c) Describe the appearance of the mixture in the conical flask at the end of each experiment.

..... [1]

(d) (i) **From your graph**, deduce the time taken for the printed words to disappear from view if Experiment 2 were repeated using 20 cm^3 of aqueous sodium thiosulfate and 30 cm^3 of distilled water.

Show clearly **on the grid** how you worked out your answer.

..... s [2]

[Turn over

(ii) The rate of reaction can be calculated using the equation shown.

$$\text{rate of reaction} = \frac{1}{\text{time taken}}$$

Calculate the rate of reaction using your answer from **(d)(i)**.

..... [1]

(e) (i) In which experiment, 1, 2, 3, 4 or 5, was the rate of reaction greatest?

..... [1]

(ii) Explain, in terms of particles, why the rate of reaction was greatest in this experiment.

.....

.....

..... [2]

(f) Give the name of a more accurate piece of apparatus for measuring volumes than a measuring cylinder.

..... [1]

(g) Suggest the effect on the results of using a 100 cm^3 conical flask instead of a 250 cm^3 conical flask. Explain your answer.

.....

..... [2]

(h) Sketch **on the grid** the graph you would expect if all of the experiments were repeated at a **lower** temperature. Clearly label your graph. [1]

[Total: 17]

2 You are provided with two substances, solution **A** and solid **B**.
Do the following tests on the substances, recording all of your observations at each stage.

tests on solution A

Divide solution **A** into four approximately equal portions in three test-tubes and one boiling tube.

(a) Test the pH of the first portion of solution **A**.

pH = ... [1]

(b) Add a strip of magnesium ribbon to the second portion of solution **A** in a test-tube. Shake the mixture.
Record your observations.

.....

..... [1]

(c) Add a spatula measure of copper(II) oxide to the third portion of solution **A** in a boiling tube. Warm the mixture gently.
Record your observations.

..... [1]

Keep the fourth portion of solution A for the test in (e).

[Turn over

tests on solid B

(d) Use a spatula to place approximately half of solid **B** into a hard glass test-tube. Heat solid **B** gently then strongly. Leave the hard glass test-tube to stand for approximately 1 minute.
Record your observations.

..... [2]

(e) Add the rest of solid **B** to the fourth portion of solution **A** in a test-tube. Test the gas produced.
Record your observations.

test .....

result .....
[2]

Keep the solution from the test in (e) for the test in (f).

Add an approximately equal volume of distilled water to the solution from the test in **(e)**. Shake the solution and divide it into three approximately equal portions in two test-tubes and one boiling tube.

(f) (i) Add a few drops of aqueous sodium hydroxide to the first portion of the solution in a test-tube.
Record your observations.

..... [1]

(ii) Now add an excess of aqueous sodium hydroxide to the mixture.
Record your observations.

..... [1]

(g) (i) Add a few drops of aqueous ammonia to the second portion of the solution in a test-tube.
Record your observations.

..... [1]

(ii) Now add an excess of aqueous ammonia to the mixture.
Record your observations.

..... [1]

(h) Add a small piece of aluminium foil and about 2 cm^3 of aqueous sodium hydroxide to the third portion of the solution in a boiling tube. Gently warm the mixture. Test the gas produced with indicator paper.
Record your observations.

..... [2]

(i) Identify solution **A**.

..... [2]

(j) Identify solid **B**.

..... [2]

[Total: 17]

3 Potassium chloride is a salt that dissolves in water.
The solubility of a salt is the mass in grams of the salt that dissolves in 100 cm^3 of water at a particular temperature.

Plan an investigation to determine the solubility of potassium chloride in water at 40 °C.

You are provided with potassium chloride and common laboratory apparatus.

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

[Total: 6]

Notes for use in qualitative analysis
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.
bromide (Br^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream 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, then add aqueous barium nitrate	white ppt.
sulfite (SO_3^{2-})	add dilute hydrochloric acid, warm gently and test for the presence of sulfur dioxide	sulfur dioxide produced will turn acidified aqueous potassium manganate(VII) from purple to colourless

Tests for aqueous cations

cation	effect of aqueous sodium hydroxide	effect of aqueous ammonia
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., or very slight white ppt.
chromium(III) (Cr^{3+})	green ppt., soluble in excess	grey-green ppt., insoluble in excess
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
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 test results
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
sulfur dioxide (SO_2)	turns acidified aqueous potassium manganate(VII) from purple to colourless

Flame tests for metal ions

metal ion	flame colour
lithium (Li^+)	red
sodium (Na^+)	yellow
potassium (K^+)	lilac
copper(II) (Cu^{2+})	blue-green