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Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

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CO-ORDINATED SCIENCES **0654/53**

Paper 5 Practical Test **May/June 2025**

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 60.
- The number of marks for each question or part question is shown in brackets [ ].
- Notes for use in qualitative analysis are provided in the question paper.

For Examiner's Use	
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6	
Total	

This document has **20** pages. Any blank pages are indicated.

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1 Urine tests are commonly used for the diagnosis of diseases.

You are going to investigate four samples **A**, **B**, **C** and **D** that react like urine.

You are going to determine if there is any indication of disease.

(a) Read through the procedure and draw a table to record your observations for samples **A**, **B** and **C** in the space provided.

[2]

(b) **(i)** **Procedure**

Testing samples **A**, **B** and **C**.

- Add approximately 1 cm depth of sample **A** to each of two test-tubes.
- Add approximately 1 cm depth of Benedict's solution to one of the test-tubes and place in the hot water-bath for at least 2 minutes.
- Add about 1 cm depth of biuret solution to the other test-tube.
- Record in your results table in **(a)** the final colour observed for each of the test-tubes.

Repeat the procedure with sample **B** instead of sample **A**.

Repeat the procedure with sample **C** instead of sample **A**.

[5]

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(ii) The tests in the procedure are used to detect chemicals in a urine sample.

The reducing sugar glucose and proteins are **not** usually present in the urine of a healthy person.

People with diabetes have glucose in their urine.
People with nephritis have proteins in their urine.

State if the observations indicate the presence of diabetes, nephritis or if the person is healthy.

Explain your answer.

sample **A** ....

....

sample **B** ....

....

sample **C** ....

....
[3]

(c) **(i)** **Procedure**

Testing sample **D**.

- Dip the urine testing strip into sample **D**.
- Remove the testing strip.
- Compare the colour observed on the testing strip with the colour chart provided.

Use the colour chart to estimate the concentration of glucose in sample **D**.

.... [1]

(ii) People use the testing strips instead of using the test with Benedict's solution.

Give **two** reasons why people use testing strips instead of doing the test with Benedict's solution.

Do **not** include cost in your answer.

1 ....

....

2 ....

....
[2]

[Total: 13]

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2 The pH of urine in a healthy person is approximately 6.5.

A student suggests that the pH of urine changes as the amount of water a person drinks during the day changes.

Plan an investigation to determine the relationship between the volume of water a person drinks and the pH of their urine three hours later.

You may use any common laboratory apparatus in your plan.

You are **not** required to do this investigation.

In your plan, include:

- the apparatus and chemicals you will need
- a brief description of the method
- the measurements you will make and how you make them as valid as possible
- the variables you will control
- how you will process your results to reach a conclusion.

You may include a results table if you wish. You are **not** required to enter any readings in the table.

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[7]

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3 You are going to investigate the effect of concentration on the rate of a reaction.

When aqueous sodium thiosulfate reacts with aqueous iron(III) nitrate, the reaction mixture immediately turns a dark brown-purple colour. This colour then starts to fade.

The time taken for the colour of the mixture to fade is called the reaction time, and is used to find the rate of the reaction.

Fig. 3.1 shows the experiment.

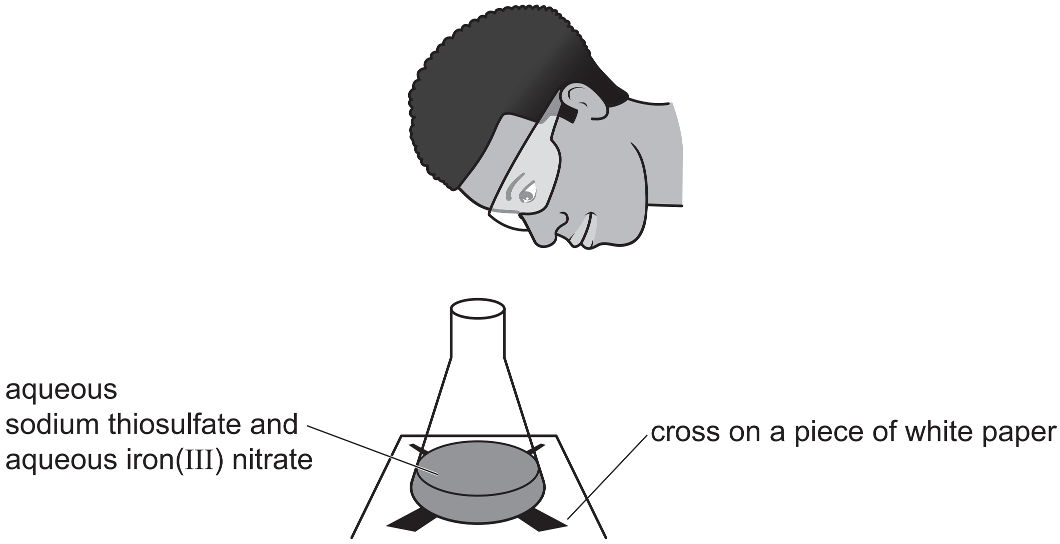

Fig. 3.1

When the colour fades, the cross on the paper becomes visible through the reaction mixture.

Aqueous sodium thiosulfate is made less concentrated by adding water to it.

(a) Procedure

- Using the measuring cylinder labelled **S**, add 30 cm^3 of aqueous sodium thiosulfate to a conical flask.
- Place the conical flask on the piece of white paper marked with a cross.
- Using the measuring cylinder labelled **I**, measure 25 cm^3 of aqueous iron(III) nitrate.
- Add the aqueous iron(III) nitrate to the flask, swirl and immediately start a stop-watch.
- Look through the mixture and when the cross **just** becomes visible, stop the stop-watch.
- Record in Table 3.1 this reaction time in seconds to the nearest second. If the time takes longer than 300 s, put > 300 s in Table 3.1.

Repeat the procedure using the quantities of aqueous sodium thiosulfate, water and aqueous iron(III) nitrate shown in Table 3.1. The water needs to be added to the aqueous sodium thiosulfate **before** the aqueous iron(III) nitrate is added.

Use the measuring cylinder labelled **W** to measure the volume of water.

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Table 3.1

volume of aqueous sodium thiosulfate / cm^3	volume of water / cm^3	volume of aqueous iron(III) nitrate / cm^3	reaction time / s	rate of reaction per 1000 s
30	0	25		
20	10	25		
15	15	25		
10	20	25		

[4]

(b) **(i)** Describe **one** difficulty in determining the reaction time.

....

.... [1]

(ii) State what happens to the reaction time when the volume of aqueous sodium thiosulfate is doubled.

Explain your answer using data from Table 3.1.

statement ....

explanation ....

....

[1]

(c) **(i)** Calculate the rate of each reaction.

Use the equation shown.

$$\text{rate of reaction} = \frac{1000}{\text{time}}$$

Record in Table 3.1 your values to **two** significant figures. [2]

(ii) State the relationship between concentration of aqueous sodium thiosulfate and rate of reaction.

....

.... [1]

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(d) (i) Name **one** piece of apparatus suitable for measuring 25 cm^3 more accurately than a measuring cylinder.

.... [1]

(ii) Suggest why the total volume in the conical flask must be the same for each experiment.

Do **not** include fair test in your answer.

....

.... [1]

(iii) Suggest why repeating the experiment several times increases confidence in the results.

....

.... [1]

(e) A reaction happens when reactant particles collide with each other.

When the concentration increases, there are more particles in the solution and they are closer together.

Suggest why the **rate** of reaction changes as the concentration of the aqueous sodium thiosulfate changes.

....

.... [1]

[Total: 13]

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4 You are going to identify the ions present in aqueous **H**.

(a) Procedure

- Put 2 cm depth of aqueous **H** into 5 test-tubes.
- Put a splint into one of these test-tubes for use in test **5**.
- Do the tests shown in Table 4.1 using separate test-tubes of aqueous **H** for each test.
- Record all observations in Table 4.1.

Table 4.1

test number	test	observations
1	add a few drops of aqueous sodium hydroxide add excess aqueous sodium hydroxide	
2	add a few drops of aqueous ammonia add excess aqueous ammonia	
3	add dilute nitric acid and aqueous barium nitrate	
4	add dilute nitric acid and aqueous silver nitrate	
5	flame test	

[5]

(b) State the identity of all of the ions in aqueous **H**.

....

.... [1]

(c) Explain why dilute nitric acid is added in tests **3** and **4**.

....

.... [1]

[Total: 7]

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5 You are going to investigate how the resistance of a lamp depends on the potential difference across the lamp.

The circuit shown in Fig. 5.1 is assembled for you.

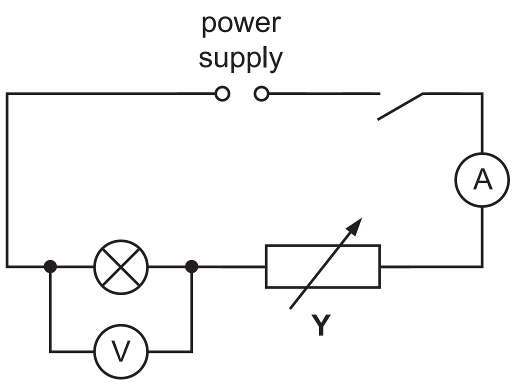

Fig. 5.1

(a) **(i)** State the name of component **Y**.

.... [1]

(ii) You are going to measure the current *I* and the potential difference *V*.

Component **Y** changes the values of *I* and *V*.

Procedure

- Close the switch.
- Slowly adjust component **Y** until *V* is 0.3 V.
- Record in Table 5.1 the current *I*.
- Open the switch.

Table 5.1

potential difference *V* / V	current *I* / A	resistance *R* / Ω
0.3		
0.8		
1.3		
1.8		
2.1		
2.5		

[1]

(iii) Repeat the procedure in **(a)(ii)** for the other values of *V* shown in Table 5.1.

Record your results in Table 5.1. [3]

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(iv) Calculate the resistance *R* for each current.

Use the equation shown.

$$R = \frac{V}{I}$$

Record in Table 5.1 your values of *R*. [1]

(v) Suggest why it is good experimental practice to open the switch between readings.

....

.... [1]

(b) **(i)** On the grid, plot resistance *R* (vertical axis) against potential difference *V*.

[3]

(ii) Draw the line of best fit. [1]

(iii) Use your graph to describe the relationship between *R* and *V*.

....

.... [1]

(iv) A student says *R* is directly proportional to *V*.

State if the student is correct.

Explain your answer.

statement ....

explanation ....

....
[1]

[Total: 13]

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6 You are going to calculate the spring constant k of a spring.

The spring constant is a measure of the stiffness of a spring.

The apparatus in Fig. 6.1 is assembled for you.

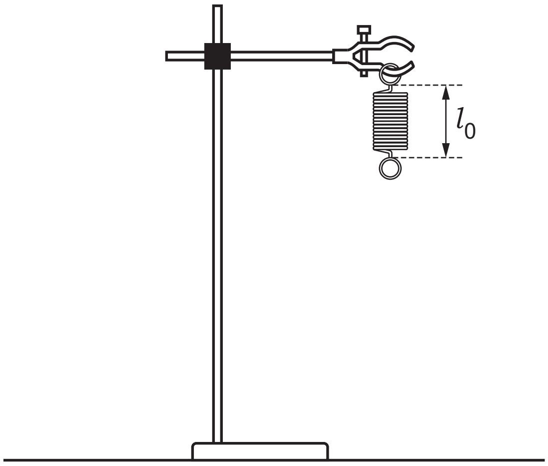

Fig. 6.1

(a) (i) Procedure

- Record the length l_0 of the unstretched spring in cm to the nearest 0.1 cm.
  Do **not** include the loops at either end of the spring in your measurement.

l_0 = ... cm

- Suspend a mass of 200 g from the spring.
- Record the length l_1 of the stretched spring in cm to the nearest 0.1 cm as shown in Fig. 6.2.

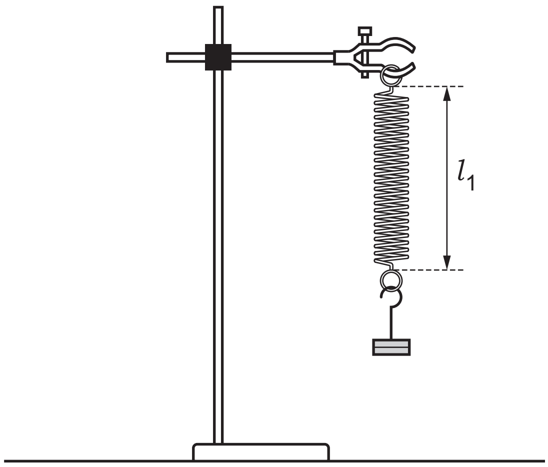

Fig. 6.2

l_1 = ... cm [2]

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(ii) Calculate the extension *e* of the spring.

Use the equation shown.

$$e = l_1 - l_0$$

e = ... cm [1]

(iii) Calculate the spring constant *k*.

Use the equation shown.

$$k = \frac{2.0}{e}$$

k = ... N/cm [1]

(b) **(i)** A teacher does the same experiment and calculates the spring constant *k* as 0.31 N/cm.

Two values are considered to be equal within the limits of experimental error if they are within 10% of each other.

State if your value for *k* in **(a)(iii)** and the teacher's value are equal within the limits of experimental error.

Justify your answer with a calculation.

....

.... [2]

(ii) Another student does the same experiment using a mass of 200 g but uses a spring with a larger spring constant.

Suggest a value for the extension *e*.

Explain your answer.

value .... cm

explanation ....

....
[1]

[Total: 7]

NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests for anions

anion	*test*	*test result*
carbonate, CO_3^{2-}	add dilute acid, then test for carbon dioxide gas	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 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*
ammonium, NH_4^+	ammonia produced on warming	–
calcium, Ca^{2+}	white ppt., insoluble in excess	no ppt. or very slight white 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, ppt. turns brown near surface on standing	green ppt., insoluble in excess, ppt. turns brown near surface on standing
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 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

Flame tests for metal ions

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

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