Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME										
CENTRE NUMBER						CANDIDATE NUMBER				

8426515997

CO-ORDINATED SCIENCES **0654/52**

Paper 5 Practical Test **October/November 2016**

2 hours

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 for this paper 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.

For Examiner's Use	
1	
2	
3	
Total	

This document consists of **12** printed pages.

DC (RW/SG) 119040/5

CAMBRIDGE International Examinations

[Turn over

1 You are going to test a procedure to investigate an enzyme-catalysed reaction.

Hydrogen peroxide is broken down by catalase, an enzyme found in living cells such as celery cells. Oxygen gas is released during the reaction.

(a) Read through parts **(a)** and **(b)**, and **complete the headings** in Table 1.1 below. [2]

- Use the syringe to place 2 cm^3 of hydrogen peroxide solution in the test-tube. Add a drop of detergent and use the stirring rod to mix well.
- Cut a 1.5 cm length from the middle of the celery stick.
- Cut this 1.5 cm length into approximately 1 mm slices. Now cut these slices in half as shown in Fig. 1.1.

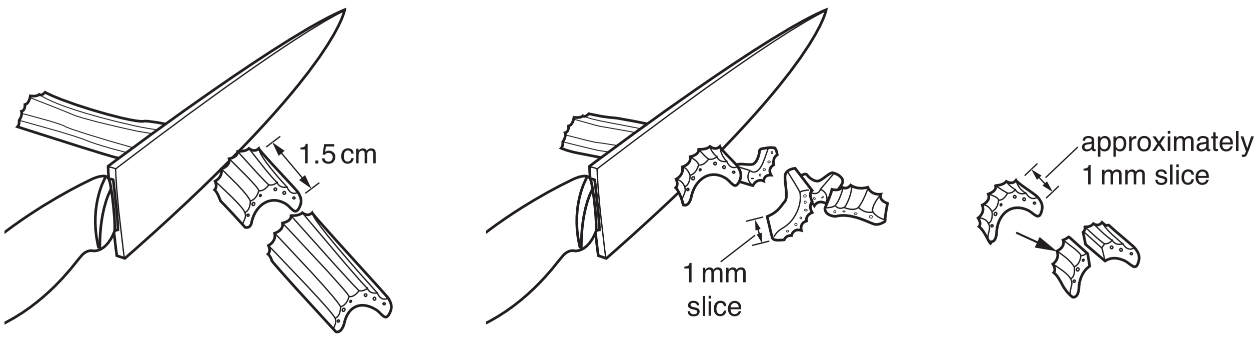


Fig. 1.1 (not to scale)

- Add these pieces to the hydrogen peroxide solution in the test-tube.
- Use the stirring rod to push the pieces into the solution and **immediately** start the stopwatch.

(b) In Table 1.1, record the height of the **liquid and bubbles**, to the nearest 0.1 cm, in the test-tube every 2 minutes for 10 minutes. [3]

Table 1.1

.... /	.... / ....
2	
4	
6	
8	
10	

(c) On the grid provided, plot a graph of liquid and bubble height (vertical axis) against time (horizontal axis).

Draw a best-fit curve. [4]

(d) Describe how you could check the precision of your results.

....

....[1]

(e) Describe how you could confirm that the bubbles produced contain oxygen.

test ....

observation ....
[2]

(f) A student uses the method in **(a)** to investigate the effect of temperature on this enzyme-catalysed reaction.

(i) State **two** variables that the student should keep constant.

1 ....

2 ....
[1]

(ii) Suggest which temperatures the student should use.

....

....[2]

2 You are going to investigate the reaction between magnesium and copper sulfate solution. You will also find out how the reaction depends on the concentration of the copper sulfate solution.

You are provided with copper sulfate of concentration 1.00 X where X is a unit of concentration.

(a) **(i)** Using the thermometer, measure the initial temperature T_i of the copper sulfate solution and record **to the nearest half degree** in Table 2.1 the initial temperature T_i for concentration 1.00 X. [1]

Table 2.1

concentration of copper sulfate	initial temperature T_i / °C	highest temperature T_h / °C	temperature change ΔT / °C
1.00 X			
0.75 X			
0.50 X			
0.25 X			

(ii)
- Transfer one of the samples of magnesium into the plastic cup.
- Measure 24 cm^3 of copper sulfate solution using the 25 cm^3 measuring cylinder.
- Add this quickly to the magnesium in the plastic cup.
- Stir the mixture thoroughly and measure the highest temperature T_h reached.
- Record **to the nearest half degree** in Table 2.1 the highest temperature T_h for concentration 1.00 X. [1]
- Keep the mixture in the plastic cup for **(iii)**.

(iii) Observe the colour of the solid in the mixture and suggest its identity.

colour ....

identity of solid ....
[2]

(iv) Pour the contents of the plastic cup into the large beaker labelled **waste** and thoroughly rinse out the plastic cup with water.

Make a copper sulfate solution of lower concentration, 0.75 X, using the following method.

- Measure 6 cm^3 of water using the 10 cm^3 measuring cylinder and add this to the small beaker.
- Measure 18 cm^3 of copper sulfate solution using the 25 cm^3 measuring cylinder and add this to the water in the small beaker.
- Stir the mixture to ensure an even solution.
- Measure the initial temperature T_i of this 0.75 X copper sulfate solution and record **to the nearest half degree** in Table 2.1, in **(a)(i)**, the initial temperature T_i for concentration 0.75 X. [1]
- Keep this solution for **(v)**.

The volumes used are shown in Table 2.2.

Table 2.2

concentration of copper sulfate	volume of copper sulfate / cm^3	volume of water / cm^3
1.00 X	24	0
0.75 X	18	6
0.50 X	12	12
0.25 X	6	18

(v)
- Transfer another of the samples of magnesium into the plastic cup.
- Add the 0.75 X copper sulfate solution, made in **(iv)**, from the small beaker quickly to the magnesium in the plastic cup.
- Stir the mixture thoroughly and measure the highest temperature T_h reached.
- Record **to the nearest half degree** in Table 2.1, in **(a)(i)**, the highest temperature T_h for concentration 0.75 X. [1]

(vi) Repeat **(a)(iv)** and **(a)(v)** using the volumes of water and copper sulfate for 0.50 X copper sulfate solution and then 0.25 X copper sulfate solution as shown in Table 2.2.

Record **to the nearest half degree** in Table 2.1, in **(a)(i)**, the initial temperatures T_i and the highest temperatures T_h. [2]

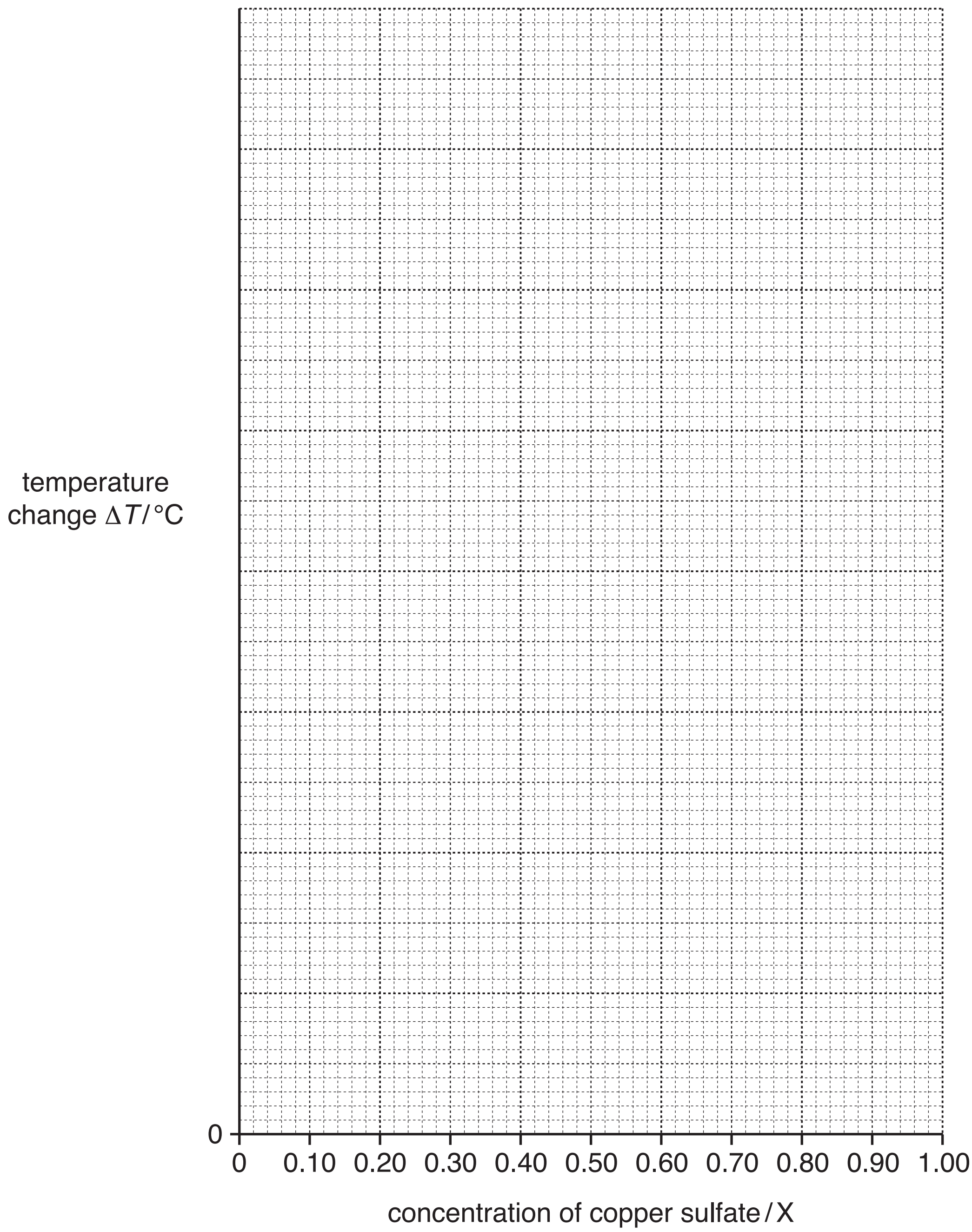
(b) **(i)** Calculate the temperature change Δ*T* during the reaction for each concentration of copper sulfate.

Record these values in the last column of Table 2.1 in **(a)(i)**.

[1]

(ii) Using the data in Table 2.1, in **(a)(i)**, plot a graph of temperature change Δ*T* against concentration of copper sulfate solution on the grid provided.

Draw the best-fit straight line that passes through the origin. [3]



(iii) A student states that the temperature change ΔT for this experiment depends directly on the concentration of the copper sulfate solution used.

Suggest whether this is supported by your data and justify your answer.

....

....

....[1]

(c) Using the data in Table 2.1, in **(a)(i)**, state the name of the type of chemical reaction that produces these temperature changes.

....[1]

(d) Suggest **one** change to this procedure to improve the accuracy of the results.

....

....[1]

Please turn over for Question 3.

3 You are going to find the mass of a piece of modelling clay using a balancing method.

You are provided with a metre rule, a pivot and a piece of modelling clay.

(a) Mould the piece of modelling clay until it is roughly cube-shaped. Place the modelling clay on the metre rule so that its centre is 15.0 cm from the zero end of the rule, as shown in Fig. 3.1.

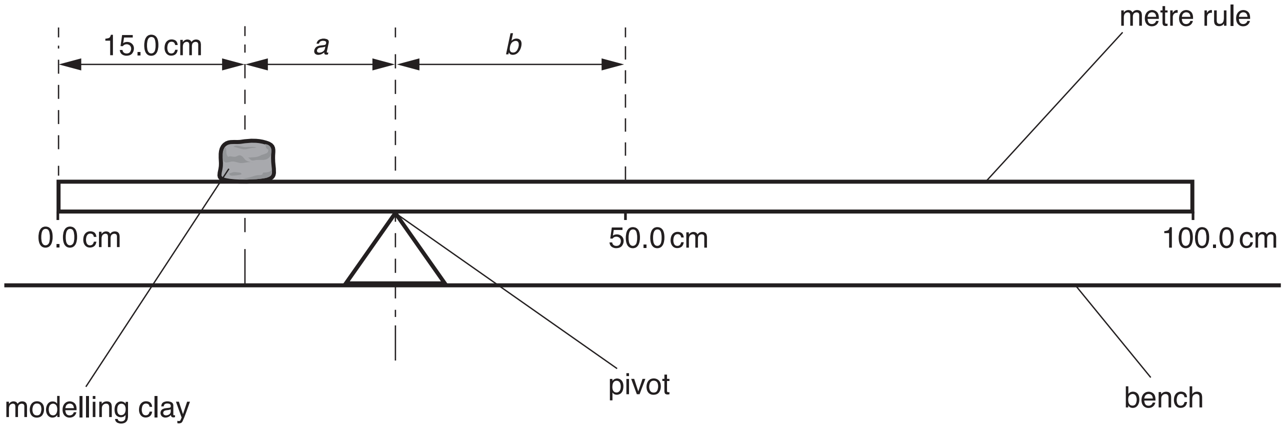


Fig. 3.1 (not to scale)

(i) Adjust the position of the pivot so that the rule balances on it. Record to the nearest 0.1 cm the distance *a* from the centre of the modelling clay to the pivot as shown in Fig. 3.1.

a = ... cm [1]

(ii) Record to the nearest 0.1 cm the distance *b* from the pivot to the 50.0 cm mark, as shown in Fig. 3.1.

b = ... cm [1]

(iii) Describe how you ensured that the centre of the modelling clay was directly above the 15.0 cm mark on the metre rule. You may draw a diagram, if you wish.

....

....[1]

(b) Use the balance provided to measure the mass *M* of the metre rule to the nearest gram.

M = ... g [1]

(c) Calculate the mass m of the piece of modelling clay using the equation shown.

$$m = M \times \frac{b}{a}$$

Give your answer to an appropriate number of significant figures.

m = ... g [2]

(d) Break the piece of modelling clay into two pieces, so that one piece is approximately twice the size of the other.

(i) Repeat the procedure in part **(a)** using the larger piece of modelling clay. Record the new distances a_L and b_L.

a_L = ... cm

b_L = ... cm [2]

(ii) Calculate the mass m_L of the larger piece of modelling clay using your values from **(d)(i)** and the mass M of the ruler from part **(b)**, using the equation shown.

$$m_L = M \times \frac{b_L}{a_L}$$

m_L = ... g [1]

(e) **(i)** Repeat the procedure in part **(a)** with the smaller piece of modelling clay.

a_S = ... cm

b_S = ... cm [1]

(ii) Use your values from **(e)(i)** to calculate the mass m_S of the smaller piece of modelling clay.

m_S = ... g [2]

(f) Calculate the value of $m_L + m_S$.

$m_L + m_S$ = ... g [1]

(g) Even if you have carried out the experiment very carefully, your value for $m_L + m_S$ may not be equal to your value for m. Suggest **two** reasons for this.

1 ....

2 ....

[2]

NOTES FOR USE IN QUALITATIVE ANALYSIS

Test 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.
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.

Test for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
ammonium (NH_4^+)	ammonia produced on warming	–
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

Test 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

