Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

4397312736

CO-ORDINATED SCIENCES **0654/53**

Paper 5 Practical Test **October/November 2017**

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 **11** printed pages and **1** blank page.

DC (NH/SW) 140113/2

CAMBRIDGE International Examinations

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

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

Read through the whole question before starting.

(a) **(i)** Fig. 1.1 shows how to prepare four different sized pieces of potato.

Proceed as follows.

Step 1

- Cut two cubes of potato approximately 1 cm × 1 cm × 1 cm without the skin.
- Place one of these cubes into the Petri dish provided.
- Cut the other cube in half (cut 1, shown in Fig. 1.1).
- Place one of these pieces into the Petri dish provided.
- Cut the other piece in half (cut 2, shown in Fig. 1.1).
- Place one of these pieces into the Petri dish provided.
- Cut the other piece in half (cut 3, shown in Fig. 1.1).
- Place one of these pieces into the Petri dish provided.
- Discard the remaining piece into the container labelled **waste**.

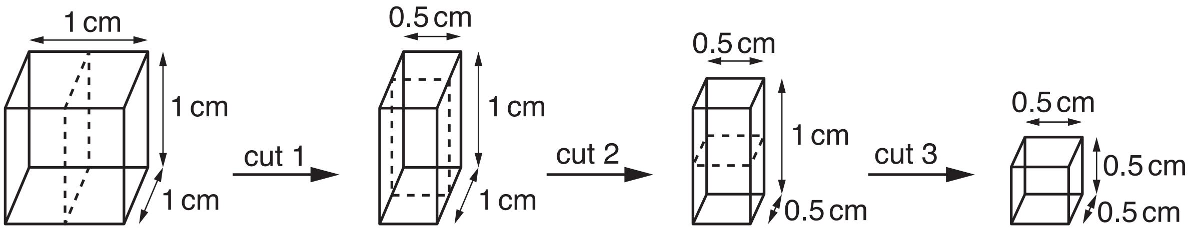


Fig. 1.1

Step 2

- Place the large piece of potato into a large test-tube.
- Add one drop of detergent.
- Use the syringe to add 5 cm^3 hydrogen peroxide by carefully running it down the inside of the test-tube and immediately start the stopclock.
- When the stopclock records 2 minutes 30 seconds, use the marker provided to mark the highest point of the foam in the test-tube.
- Leave the test-tube in the rack.

Repeat **step 2** with the remaining three different-sized pieces of potato in the Petri dish. Use a different test-tube each time.

Step 3

- For each test-tube, measure the distance *d* from the surface of the liquid to the mark you made in **step 2**.

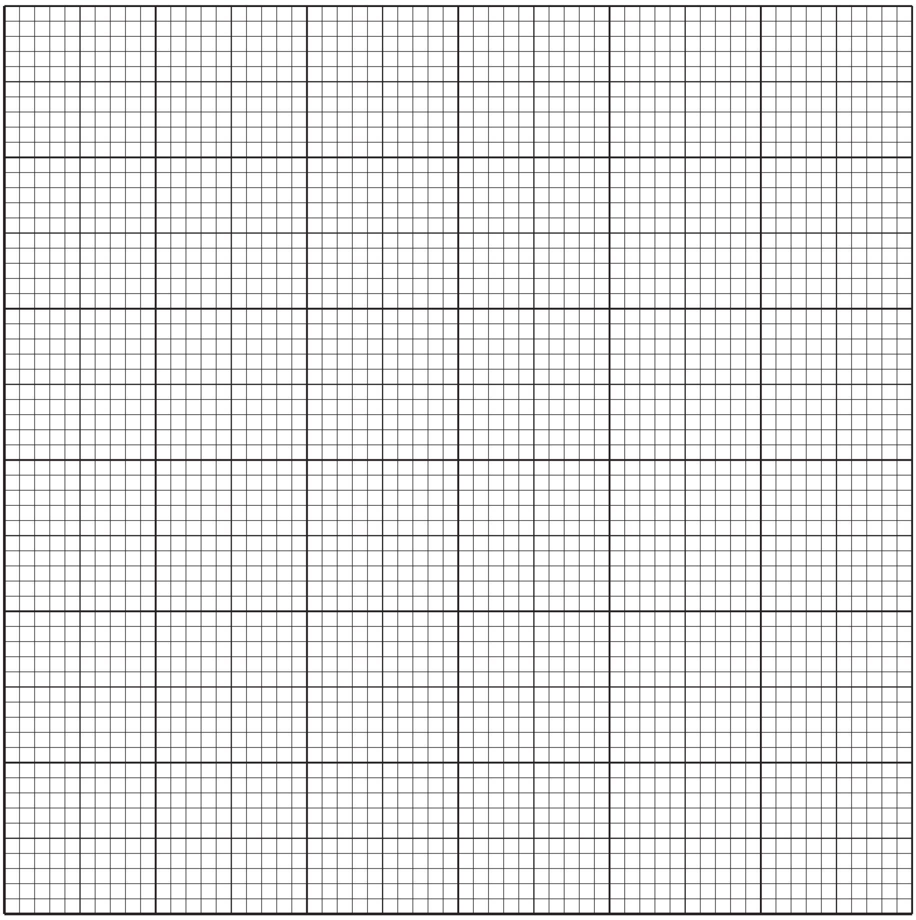
  Record, in Table 1.1, these distances in cm to the nearest 0.1 cm. [3]

(ii) Insert the missing units in Table 1.1. [1]

Table 1.1

dimensions of potato piece / cm	surface area of potato piece /........................	distance *d* /........................
1 × 1 × 1	6.0	
1 × 1 × 0.5	4.0	
1 × 0.5 × 0.5	2.5	
0.5 × 0.5 × 0.5	1.5	

(b) (i) On the grid provided, plot a graph of distance *d* (vertical axis) against surface area of potato piece.
Draw the best-fit straight line through the origin.



[4]

(ii) Use your graph to state the relationship between the amount of enzyme and the rate of reaction.

....

....[1]

(iii) Use your graph to predict the distance *d* for a piece of potato with a surface area of 3.0.

Mark on the graph how you did this.

d = ...[2]

(c) Describe how you could confirm that the gas produced in this reaction is oxygen.

test ....

observation ....
[1]

(d) During this experiment, the volume of hydrogen peroxide was kept constant for each piece of potato.

Identify **two** other variables that should be kept constant.

variable 1 ....

variable 2 ....
[2]

(e) The rate of reaction is more dependent on the surface area of the potato than on its volume.

Explain why.

....

....[1]

2 Notes for use in Qualitative Analysis for this question are printed on page 12.

You are going to carry out reactions with compounds **H** and **J**.
This will allow you to identify **H**.

(a) **(i)** Remove the stopper from the hard glass test-tube containing a sample of solid **H**.

Using the delivery tube, connect the test-tube containing **H** to another test-tube one-third filled with limewater.

Draw a labelled diagram of this apparatus.

[1]

(ii) Heat the hard glass test-tube containing solid **H**, connected as in **(a)(i)**, until no further changes are observed in the limewater.

Disconnect the delivery tube before you stop heating to avoid suck back.

Note any changes that take place when the solid cools.

Record your observations of both **H** and the limewater.

H ....

....

....

limewater ....

....

....

[4]

(b) **(i)** Place 0.5 cm depth of solid **H** into a clean test-tube and slowly add dilute hydrochloric acid until the test-tube is half-full. Allow the mixture to react fully and dissolve.

Record your observations.

Keep this mixture for **(b)(ii)**.

....

....[1]

(ii) Pour about 1 cm^3 of the solution from **(b)(i)** into a large test-tube. **Slowly** add aqueous sodium hydroxide to the solution in the large test-tube until there is no further change.

Record your observations.

....

....

....[2]

(c) Use your observations in **(a)** and **(b)** to identify **H**.

H is ....[2]

(d) The solution of **J** contains a potassium salt. It has been acidified with dilute nitric acid for you.

J is not a nitrate.

(i) Draw a suitable table for entering the observations of the reactions between a solution of **J** and

- barium nitrate solution
- silver nitrate solution.

[1]

(ii) Carry out the tests in **(d)(i)** and record your observations in the table you have drawn. [2]

(iii) Place about 2 cm^3 of solution **J** into a test-tube and add an equal amount of chlorine water.

Record your observations.

....

....[1]

(iv) Use your observations in **(d)(ii)** and **(d)(iii)** to make **one** conclusion about the anion in **J**.

conclusion about the anion in **J** ....

....[1]

3 You are going to measure the focal length of a convex lens.

Set up the apparatus as shown in Fig. 3.1.

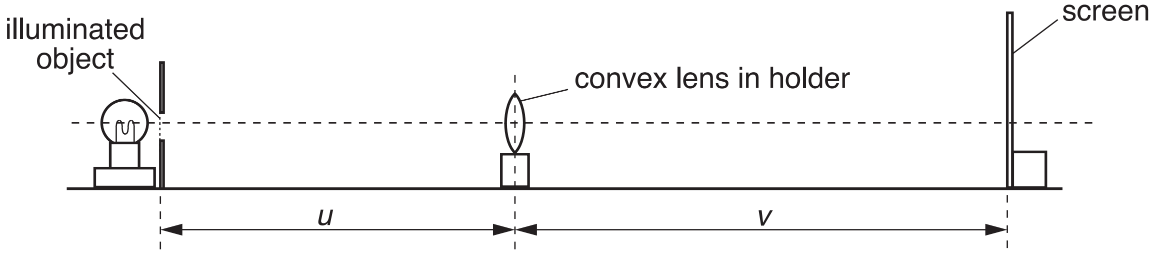


Fig. 3.1

(a) **(i)**
- Switch on the lamp and place the lens a distance u = 30.0 cm from the illuminated object.
- Adjust the position of the screen by moving it backwards and forwards along the bench until a sharp triangular image of the illuminated object is formed on the screen.
- Measure, to the nearest millimetre, the image distance v from the screen to the lens.

Record the distance v in Table 3.1. [2]

Table 3.1

u / cm	v / cm	$\frac{u}{v}$	$(1 + \frac{u}{v})$
30.0			
35.0			
40.0			
45.0			
50.0			

(ii) Repeat the procedure described in **(a)(i)** for values of u = 35.0 cm, 40.0 cm, 45.0 cm and 50.0 cm. [2]

(iii) Calculate the ratio $\frac{u}{v}$ for each pair of values of u and v.

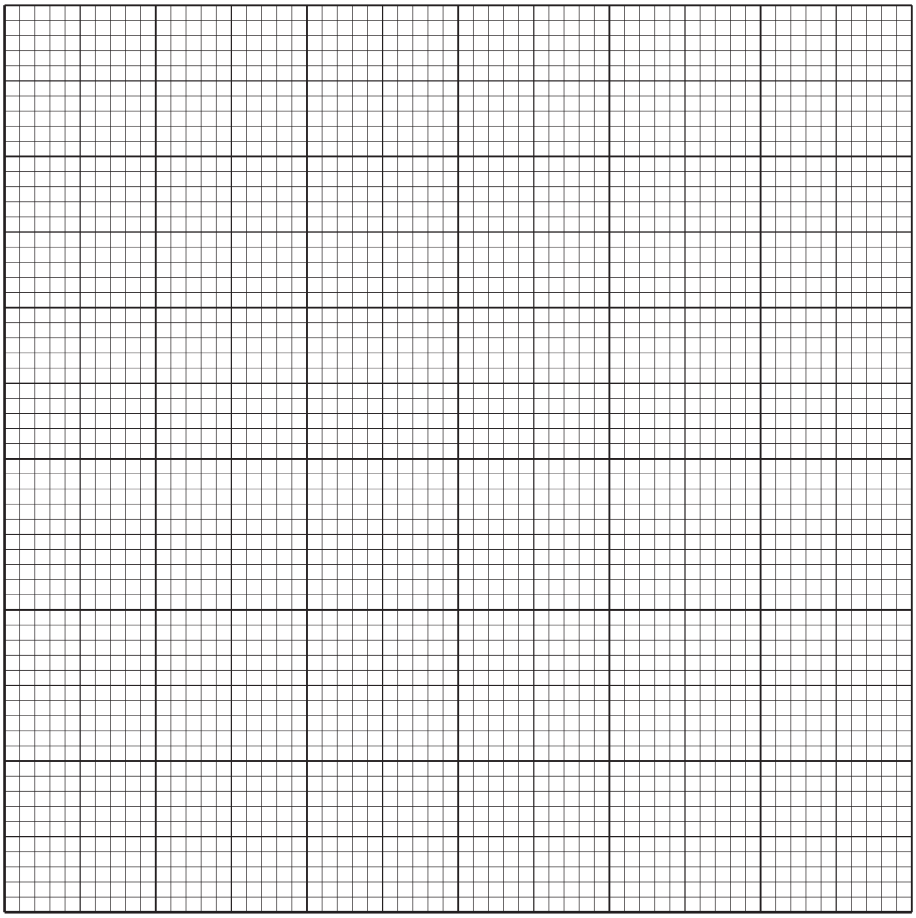
Record, in Table 3.1, these ratios. [1]

(iv) Calculate the values of $(1 + \frac{u}{v})$ **and** record them in Table 3.1. [1]

(b) **(i)** On the grid provided, plot a graph of u (vertical axis) against $(1 + \frac{u}{v})$.

Draw the best-fit straight line. The horizontal and vertical axes do **not** need to start from (0,0).

u / cm



$(1 + \frac{u}{v})$

[3]

(ii) Calculate the gradient of your line.

Show all your working and indicate on your graph the values you chose to enable the gradient to be calculated.

gradient = ... cm [2]

(iii) The gradient of your graph is equal to the focal length f of the lens.

Write down the value of f to an appropriate number of significant figures.

f = ... cm [2]

(c) State **two** precautions that you should take in this experiment to obtain reliable results.

precaution 1 ....

....

precaution 2 ....

....
[2]

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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