CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CO-ORDINATED SCIENCES **0654/53**

Paper 5 Practical Test **October/November 2019**

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 16.

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	
4	
5	
6	
Total	

This document consists of **15** printed pages and **1** blank page.

[Turn over

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 yeast cells. Oxygen gas is released during the reaction and a foam is produced.

(a) (i) Procedure

- Stir the yeast suspension.

- Pour yeast suspension into the measuring cylinder up to the $3\,cm^3$ graduation.

- Using the syringe, quickly add **$1\,cm^3$** of hydrogen peroxide to the yeast in the measuring cylinder.

- Immediately start the stopclock.

- Read the total volume of the liquid and foam produced every 30 seconds for 150 seconds.

- Record in Table 1.1 your values to the nearest $0.5\,cm^3$. The volume at time = 0 has been recorded for you.

- Empty out the measuring cylinder and rinse with the distilled water provided.

[2]

Table 1.1

| time / s	total volume of liquid and foam / cm^3	
	$1\,cm^3$ hydrogen peroxide	$2\,cm^3$ hydrogen peroxide
0	4.0	5.0
30		
60		
90		
120		
150		

(ii) Repeat the procedure in **(a)(i)** using **$2\,cm^3$** hydrogen peroxide instead of $1\,cm^3$ hydrogen peroxide. [2]

(b) On the grid provided, plot graphs of the total volume of liquid and foam against time for **both** $1\,cm^3$ **and** $2\,cm^3$ hydrogen peroxide.

- Choose a suitable scale.

- Plot a graph of total volume of liquid and foam against time for **2 cm³** hydrogen peroxide.

- Draw the best-fit line and label this line **2 cm³**.

- On the same axes, plot a graph of total volume of liquid and foam against time for **1 cm³** hydrogen peroxide.

- Draw the best-fit line and label this line **1 cm³**.

total volume of liquid and foam /cm³
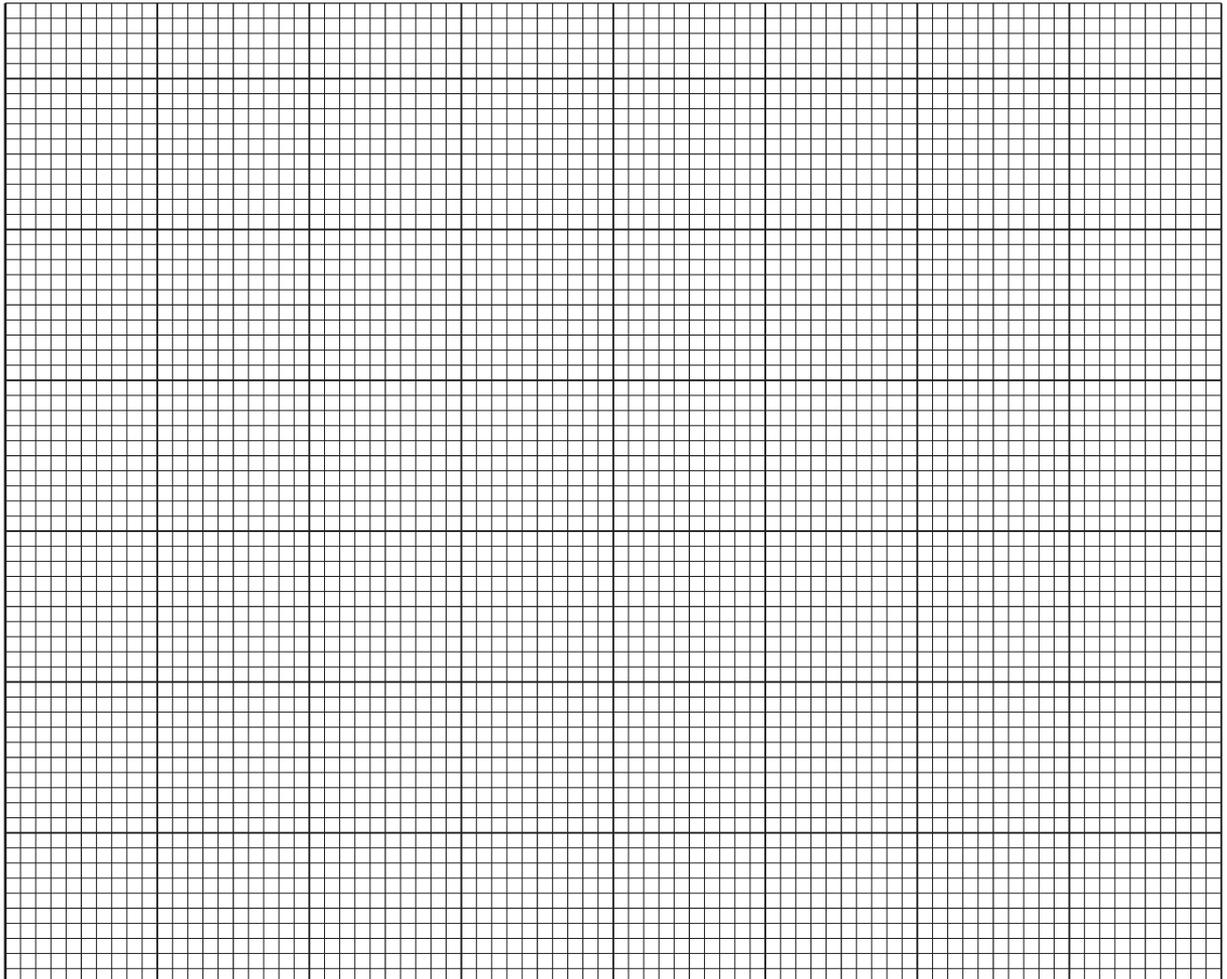
time / s

[5]

(c) State the effect of increasing the volume of hydrogen peroxide used on the rate of this reaction during the first 90 seconds.

.... [1]

(d) Identify a source of inaccuracy in obtaining your volume readings of the liquid and foam.

Suggest an improvement to increase the accuracy of these readings.

source of inaccuracy ....

....

improvement ....

....
[2]

[Total: 12]

2 You are going to investigate the nutrient content of the yeast suspension used in Question 1.

(a) Procedure

- Place about 1 cm depth of the unused yeast suspension in each of two test-tubes.
- To one test-tube, add an equal volume of biuret solution and stir well.
- To the other test-tube, add a few drops of iodine solution.

Complete Table 2.1 by recording the final colour observed in each test-tube after adding the testing solutions.

State the conclusions from your observations.

Table 2.1

test solution	final colour observed	conclusion
biuret solution		
iodine solution		

[4]

(b) The teacher says that the yeast produces carbon dioxide during respiration.

To test for carbon dioxide the gas produced is bubbled through limewater.

(i) Draw the assembled apparatus that should be used for this test.

[1]

(ii) Label the apparatus and chemicals in your diagram in **(b)(i)**. [1]

(iii) State the observation that confirms carbon dioxide is produced.

.... [1]

(c) Before adding the yeast, the liquid used to make the yeast suspension in **(a)** is tested with biuret solution and iodine solution.

Suggest why this is done.

.... [1]

[Total: 8]

3 Magnesium ribbon reacts with dilute sulfuric acid to produce magnesium sulfate solution and hydrogen gas.

(a) Plan an experiment to investigate the effect of temperature on the rate of this reaction.

You are not required to carry out this experiment.

Your plan should include:

- a labelled diagram of the apparatus
- values of temperature you will use
- variables you will keep constant
- measurements you will take
- how the measurements will be used to find the rate of reaction
- one safety precaution.

....

....

....

....

....

....

....

....

....

.... [7]

(b) Identify two possible sources of error in your experiment.

Explain an improvement to reduce the effect of **one** of these errors.

source of error 1 ....

....

source of error 2 ....

....

improvement ....

....

[3]

[Total: 10]

4 Notes for use in Qualitative Analysis for this question are printed on page 16.

H is a solution which contains two cations and one anion.

You are going to carry out some tests and identify the ions in **H**.

(a) Identify the **anion** in **H** by carrying out the tests shown in Table 4.1.

Use fresh samples of **H** for each test.

Record in Table 4.1 your observations and conclusions, including negative conclusions to eliminate ions.

All boxes should be completed.

Table 4.1

test	observations	conclusion
add dilute hydrochloric acid		
add dilute nitric acid followed by aqueous silver nitrate		
add dilute nitric acid followed by aqueous barium nitrate		

[3]

(b) Identify the two **cations** in **H** by carrying out suitable tests on **H** with sodium hydroxide solution.

You can heat gently and test any gases with damp litmus paper.

Record in Table 4.2 your observations and conclusions.

Table 4.2

test	observations	conclusion

[5]

(c) **J** is a solid sample of **H**.

Procedure

- **Remove** the stopper from the sample of solid **J** in the hard glass test-tube.
- Heat the hard glass test-tube in a flame.
- Do **not** heat strongly and do **not** heat for more than a few minutes.
- Record your observations.

....

....

.... [2]

[Total: 10]

5 You are going to determine the volume of a drinks cup using two methods.

(a) (i) Method 1

- Place the cup with its open end facing down in the space provided below.

- Draw around the circumference of the open end of the cup with a pencil.

Measure and record to the nearest 0.1 cm, the diameter *D* of the circle you have drawn.

D = ... cm [1]

(ii) • Turn the cup over and place it with its closed end facing down in the space provided below.

- Draw around the circumference of the closed end of the cup with a pencil.

Measure and record to the nearest 0.1 cm, the diameter *d* of the circle you have drawn.

d = ... cm [1]

(b) Measure and record to the nearest 0.1 cm, the vertical height h of the cup. Fig. 5.1 shows h, but you should measure the height on **your** cup.
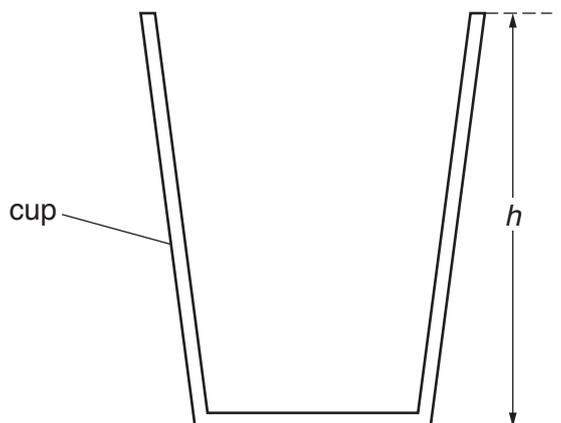
Fig. 5.1

h = ... cm [1]

(c) (i) Use your measurements from **(a)(i)** and **(a)(ii)** to calculate the average diameter d_{AV} of the cup. Use the equation shown.

$$d_{AV} = \frac{(D + d)}{2}$$

d_{AV} = ... cm [1]

(ii) Use your values from **(b)** and **(c)(i)** to calculate the volume V of the cup. Use the equation shown.

Give your answer to 3 significant figures.

$$V = 0.785 \times d_{AV}^2 \times h$$

V = ... cm^3 [2]

(d) (i) Method 2

Pour approximately 240 cm^3 of water into the measuring cylinder.

Record this volume V_1.

V_1 = ... cm^3

Pour water from the measuring cylinder into the cup until the cup is full.

Record the volume V_2 of water **remaining** in the measuring cylinder.

V_2 = ... cm^3

Calculate the volume of water V_W that the cup can hold.

V_W = ... cm^3
[1]

(ii) Describe how you read the scale of the measuring cylinder to ensure that your values for volume are as accurate as possible.

....

.... [1]

(e) (i) Suggest one practical difficulty in determining an accurate value for the volume V of the cup in **method 1**.

....

.... [1]

(ii) Suggest one practical difficulty in determining an accurate volume V_W of water that the cup can hold in **method 2**.

....

.... [1]

[Total: 10]

BLANK PAGE

6 You are going to determine the focal length of a convex lens.

Set up the apparatus as shown in Fig. 6.1.
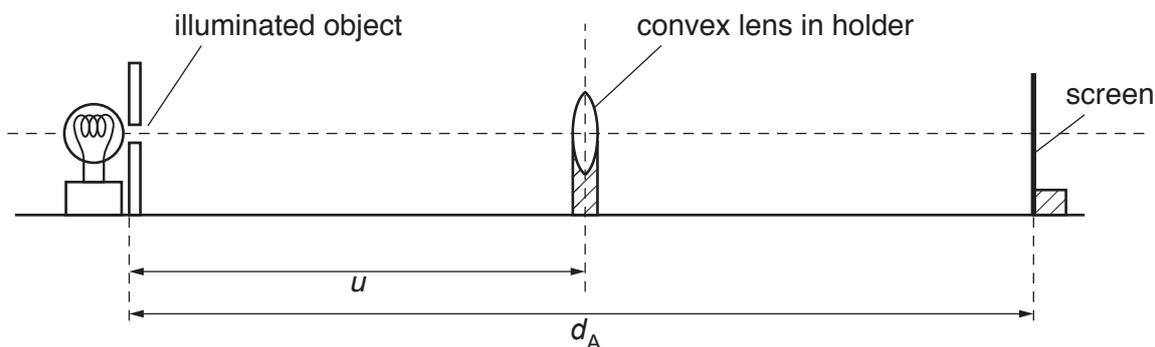
Fig. 6.1

(a) (i) Procedure

- 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 and record to the nearest 0.1 cm the distance d_A from the illuminated object to the screen.

d_A = ... cm [1]

(ii) Calculate the focal length f_A of the lens. Use the equation shown.

$$f_A = \frac{30.0 \times (d_A - 30.0)}{d_A}$$

f_A = ... cm [1]

(b) (i) Repeat the procedure in **(a)(i)** but place the lens a distance u = 40.0 cm from the illuminated object.

Measure and record to the nearest 0.1 cm, the distance d_B from the illuminated object to the screen.

d_B = ... cm [1]

(ii) Calculate the focal length f_B of the lens. Use the equation shown.

$$f_B = \frac{40.0 \times (d_B - 40.0)}{d_B}$$

f_B = ... cm [1]

(c) Use your results from **(a)(ii)** and **(b)(ii)** to calculate an average value for the focal length f of the lens.

Give your answer to an appropriate number of significant figures. Use the equation shown.

$$f = \frac{(f_A + f_B)}{2}$$

f = ... cm [2]

(d) State **one** precaution that you should take to obtain accurate results in this experiment.

....

.... [1]

(e) A student wishes to obtain more results to plot a graph to determine the focal length f of the lens.

Suggest additional values of u that the student could use.

.... [2]

(f) On Fig. 6.1 draw a line to show the image distance. Label this line v. [1]

[Total: 10]

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.
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.

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 (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 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