Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

1701019375

COMBINED SCIENCE **0653/52**

Paper 5 Practical Test **February/March 2021**

1 hour 15 minutes

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 40.
- 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	
1	
2	
3	
4	
Total	

This document has **16** pages. Any blank pages are indicated.

DC (KN/JG) 208152/2

1 You are going to investigate the rate of respiration in yeast cells. Yeast is a single-celled organism similar to plant and animal cells.

(a) You are provided with a yeast suspension, **Y**, and some yeast suspension that has been boiled, **Z**.

As yeast cells respire they produce carbon dioxide gas.

Procedure

Make sure that the yeast suspension is well mixed before using it each time.

Step 1 Set up and maintain a water-bath at approximately 40 °C.

Step 2 Label the three small test-tubes **A**, **B** and **C**.

Step 3 Put 1 cm^3 **distilled water** into test-tube **A**.

Step 4 Put 1 cm^3 **5% glucose** solution into test-tube **B**.

Step 5 Put 1 cm^3 **5% glucose** solution into test-tube **C**.

Step 6 Fill test-tube **A** to the top with yeast suspension **Y**.

Step 7 Fill test-tube **B** to the top with yeast suspension **Y**.

Step 8 Fill test-tube **C** to the top with boiled yeast suspension **Z**.

Step 9 Place a large test-tube (boiling tube) over the top of test-tube **A** and quickly turn both test-tubes upside down as shown in Fig. 1.1.

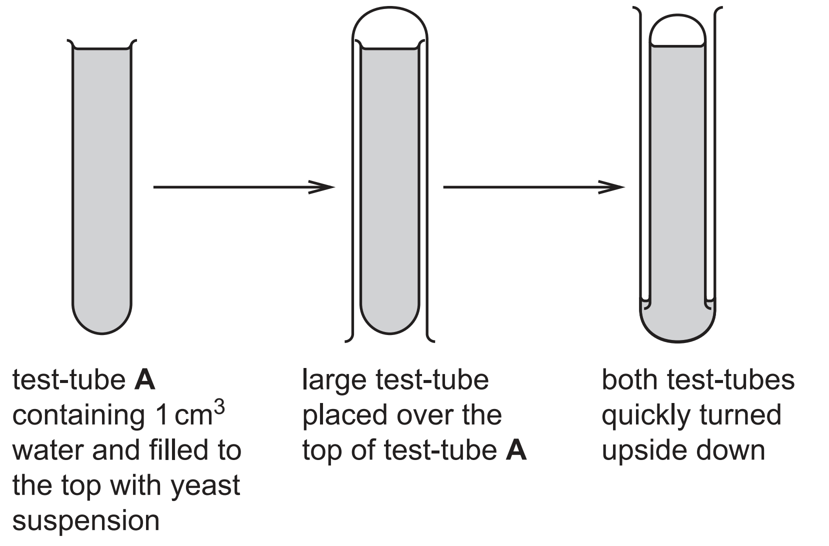


Fig. 1.1

Step 10 Place both test-tubes into the water-bath.

Step 11 Repeat **step 9** and **step 10** with test-tubes **B** and **C**.

Step 12 Start the stop-clock.

Step 13 Leave the test-tubes in the water-bath for 5 minutes.

(i) Suggest why the yeast suspension is mixed immediately before using it each time.

....

.... [1]

(ii) Observe what is happening to the yeast suspension in small test-tube **B**.

Record your observations.

....

.... [1]

(iii) After 5 minutes measure the height of the liquid, to the nearest mm, in the large test-tube (boiling tube), as shown in Fig. 1.2.

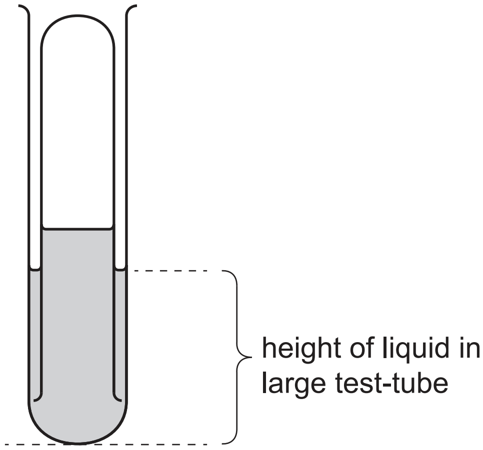


Fig. 1.2

Record your measurements in Table 1.1.

Table 1.1

test-tube	height of liquid / mm
A	
B	
C	

[3]

(iv) Test-tube **B** contains glucose.

Test-tube **A** contains no glucose.

Use this information to explain the difference in your results for test-tube **B** and test-tube **A**.

....

.... [1]

(v) Test-tube **C** is used as a type of control.

Explain the purpose of this control.

....

.... [1]

(vi) Explain why it is difficult to get an accurate value for the height of the liquid in the large test-tube.

....

.... [1]

(vii) Describe a test to find out if the gas made is carbon dioxide. Include the observation for a positive result.

test ....

....

observation ....
[1]

(b) The teacher does a similar experiment at 40 °C to investigate the effect of different concentrations of glucose on the yeast suspension. The teacher measures the volume of gas collected after 5 minutes.

The results are shown in Table 1.2.

Table 1.2

percentage concentration of glucose solution	volume of gas collected after 5 minutes / cm^3
6	3
7	8
8	13
9	17
10	17

(i) Describe the relationship between the percentage concentration of glucose solution and the volume of gas made.

....

....

....

.... [2]

(ii) Suggest a piece of apparatus suitable for collecting the gas and measuring its volume.

.... [1]

(iii) The teacher repeats their investigation at 20 °C instead of 40 °C. Suggest what effect, if any, a lower temperature has on the results.

....

.... [1]

[Total: 13]

2 You are going to prepare a sample of the insoluble salt barium sulfate by reacting aqueous copper(II) sulfate with aqueous barium nitrate.

(a) Procedure

Step 1 Use a 10 cm^3 measuring cylinder to measure 7.5 cm^3 of aqueous copper(II) sulfate and pour it into a 100 cm^3 beaker.

Step 2 Use a second 10 cm^3 measuring cylinder to measure 4.0 cm^3 of aqueous barium nitrate and pour it into the beaker.

Step 3 Stir the mixture for about 10 seconds with a glass rod.

Step 4 Filter the reaction mixture and collect the filtrate in a conical flask.

Step 5 Keep the filtrate and the residue.

(i) Explain why a 10 cm^3 measuring cylinder is used in step **1** rather than a 25 cm^3 measuring cylinder.

....

.... [1]

(ii) State one observation of the **filtrate** that shows it contains copper(II) ions.

.... [1]

(iii) Describe the appearance of the **residue** on the filter paper.

.... [1]

(b) The residue of barium sulfate is impure.

It contains some soluble copper(II) compounds.

Describe how you can purify the barium sulfate by removing the soluble copper(II) compounds from the residue.

....

.... [1]

(c) Pour 1 cm depth of the filtrate into one test-tube and another 1 cm depth of the filtrate into a second test-tube.

(i) Add aqueous ammonia drop by drop to the first test-tube until there is no further change in the appearance of the reaction mixture.

Record in detail your observations.

....

.... [1]

(ii) Add 15 drops of aqueous potassium iodide to the second test-tube.

Record your observations.

....

....

Then add about 3 cm depth of aqueous sodium thiosulfate.

Record your observations.

....

....

[2]

[Total: 7]

3 Calcium hydroxide is a white solid that is added to acidic soils to increase their pH.

Calcium hydroxide neutralises acids such as dilute nitric acid to make a salt and water.

Plan an investigation to find out how the pH of dilute nitric acid changes as calcium hydroxide is added to the acid.

You are provided with:
- calcium hydroxide powder
- dilute nitric acid
- Universal Indicator solution.

You may use any common laboratory apparatus in your plan.

You are not required to do this investigation.

In your plan, include:

- the apparatus needed
- a brief description of the method and explain any safety precautions you should take
- what you would measure
- which variables you would keep constant
- how you would process your results to draw a conclusion.

You may include a labelled diagram if you wish.

You may include a table that can be used to record the results if you wish.

....

....

....

....

....

....

....

....

....

....

....

....

....

.... [7]

4 You are going to investigate the rate at which hot water cools.

(a) Procedure

- Add approximately 300 cm^3 of water at room temperature to the beaker containing the large test-tube (boiling tube).
- Measure and record in Table 4.1 the initial temperature of the water in the beaker.
- Approximately half-fill the test-tube with **hot** water as shown in Fig. 4.1.
- Using the **other** thermometer, measure the initial temperature of the hot water in the test-tube and immediately start the stop-watch.
- Record in Table 4.1 this temperature at time t = 0.
- Record in Table 4.1 the temperature of the hot water in the test-tube and the temperature of the water in the beaker every 30 seconds for 180 s. (Use the glass rod to stir the water in the beaker before each measurement.)

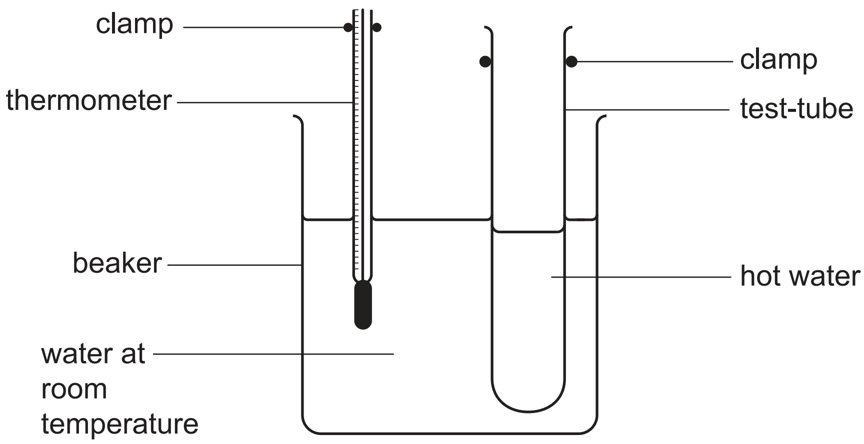


Fig. 4.1

Table 4.1

time t / s	temperature of water in	
	beaker / °C	test-tube / °C
0		
30		
60		
90		
120		
150		
180		

[3]

(b) Describe one practical technique you use to ensure the reading of the water temperature in the beaker is measured accurately.

....

.... [1]

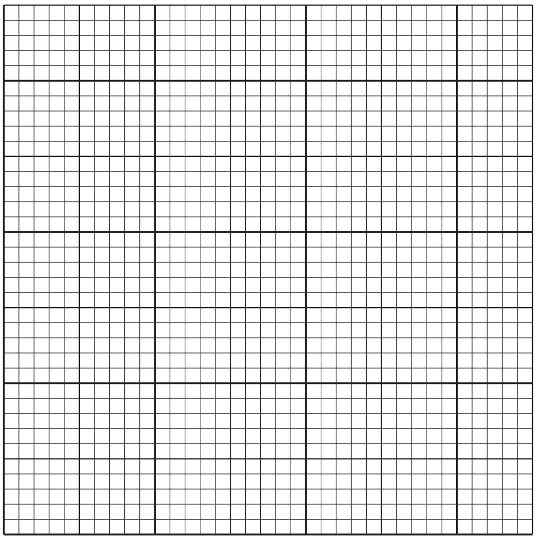
(c) Describe how the temperature of the water in the **beaker** changes during your experiment. Suggest a reason for your answer.

description ....

reason ....

....
[1]

(d) **(i)** Plot a graph of the temperature of the hot water in the **test-tube** (vertical axis) against time.
Do **not** start the temperature scale at 0 °C.



[3]

(ii) Draw the best-fit curve. [1]

(e) **(i)** Calculate the rate of cooling of the hot water in the **test-tube** during the first 30 s. Use the equation shown.

$$\text{rate of cooling during first 30 s} = \frac{\text{temperature at 0 s} - \text{temperature at 30 s}}{30}$$

Give your answer to **two** significant figures.

rate of cooling = ... °C/s [1]

(ii) Describe how the rate of cooling of the hot water in the test-tube changes during the 180 s.

....

.... [1]

(f) Suggest and explain one change you can make to this experiment which will cause the initial rate of cooling to be less.

suggestion ....

....

explanation ....

....
[2]

[Total: 13]

BLANK PAGE

BLANK PAGE

BLANK PAGE

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.
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