Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

5469302233

CO-ORDINATED SCIENCES **0654/62**

Paper 6 Alternative to Practical **October/November 2019**

1 hour 30 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

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.

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.

This document consists of **15** printed pages and **5** blank pages.

Cambridge Assessment International Education

1 A student investigates the nutrient content of yogurt and rice water.

He uses Benedict's solution, biuret solution and iodine solution.

The yogurt gives a positive result with Benedict's solution and biuret solution.

The rice water gives a positive result with iodine solution.

All other test results are negative.

(a) Complete Table 1.1 to show the student's observations of the **final colours** for each of the test-tubes. A colour should be recorded in every box.

Table 1.1

food sample	observation with Benedict's solution	observation with biuret solution	observation with iodine solution
yogurt			
rice water			

[4]

(b) Use the results to state the nutrients present in each food sample.

yogurt contains .....

rice water contains .....

[3]

(c) State which of these tests requires the use of heat.

..... [1]

(d) A student wants to compare concentrations of the nutrient tested for with Benedict's solution.

State **one** variable that would need to be kept the same.

..... [1]

(e) A student carries out this investigation but also tests samples of protein, reducing sugar and starch with the three test solutions.

Explain how this improves the investigation.

.....

..... [1]

(f) **(i)** A student tests a liquid for the presence of fats by adding two substances. He gets a positive result.

Name the two substances added in the test.

..... and .....

State his observation.

.....
[2]

(ii) Explain why the test in **(f)(i)** is not suitable for testing for the presence of fat in milk.

..... [1]

[Total: 13]

2 Fig. 2.1 shows a photograph of the cut surface of half a tomato.

Fig. 2.1

(a) In the box, make an enlarged detailed pencil drawing of Fig. 2.1.

[4]

(b) (i) Draw a straight line between points **A** and **B** on Fig. 2.1.

This is the actual width of the tomato.

Measure and record this width in millimetres to the nearest millimetre.

actual width ..... mm [1]

(ii) Draw a line to show this width on your drawing.

Measure and record the length of this line in millimetres to the nearest millimetre.

width on drawing ..... mm [1]

(iii) Use your measurements in **(b)(i)** and **(b)(ii)** to calculate the magnification *m* of your drawing. Use the equation shown.

$$m = \frac{\text{width on drawing}}{\text{actual width}}$$

m = ... [1]

[Total: 7]

3 A student investigates the reaction between zinc and aqueous copper sulfate.

(a) She records the colours of the zinc and the aqueous copper sulfate as shown in Fig. 3.1.

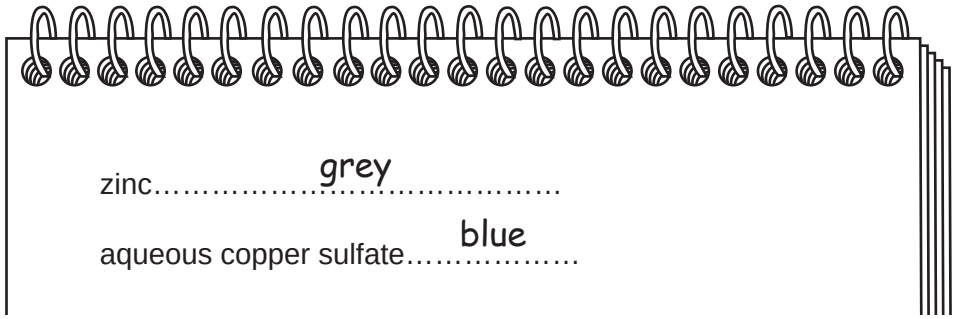


Fig. 3.1

She measures the temperature of the aqueous copper sulfate and records in Table 3.1 the value to the nearest 0.5 °C for time = 0.

Table 3.1

time / s	temperature / °C
0	20.0
30	39.0
60	41.0
90	39.5
120	38.5
150	37.5
180	
210	36.0
240	35.5
270	
300	34.0

- She places the zinc in a plastic cup.
- She adds 20 cm^3 aqueous copper sulfate to the zinc and starts the stopclock.
- She stirs the mixture continuously.
- She measures the temperature of the mixture every 30 seconds for 300 seconds.
- She records in Table 3.1 these values to the nearest 0.5 °C.

(i) Suggest a suitable piece of apparatus for measuring the volume of the aqueous copper sulfate.

.....

..... [1]

(ii) Fig. 3.2 shows the thermometer readings at time = 180 s and time = 270 s.

Fig. 3.2

Read the thermometers in Fig. 3.2 and record in Table 3.1 the temperatures to the nearest 0.5 °C. [2]

(iii) Suggest why it is **not** appropriate to record the temperatures in Fig. 3.2 to the nearest 0.25 °C.

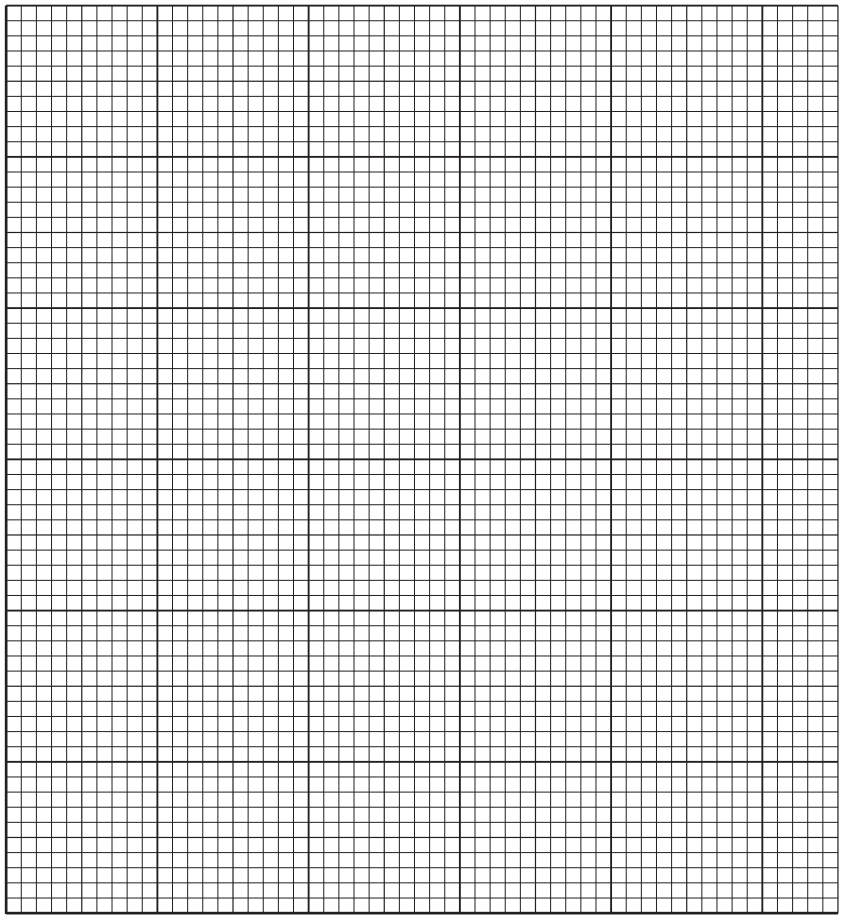
.....

..... [1]

(b) (i) Use the results in Table 3.1 to plot a graph of temperature against time.

You do **not** need to start the temperature axis at zero.

temperature / °C



time / s

[2]

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

(iii) Use the graph to find the maximum temperature reached during the experiment.

Mark this temperature on your graph.

maximum temperature .....°C [2]

(iv) The student records the colours of the solid and the liquid in the final mixture from **(a)**. These are shown in Fig. 3.3.

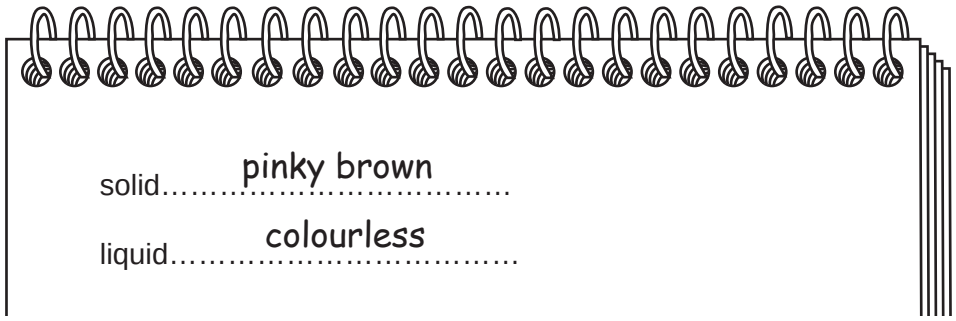


Fig. 3.3

Use these observations and those in **(a)** to suggest the name of **one** of the products of this reaction.

..... [1]

(v) Suggest the type of reaction that has taken place between zinc and aqueous copper sulfate.

type of reaction ..... [1]

(c) Suggest why the maximum temperature rise in the experiment should be more accurate when read from the graph than from the results in Table 3.1.

.....

..... [1]

[Total: 12]

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4 A student carries out tests on four aqueous solutions **H**, **J**, **K** and **L** to find out which is aqueous sodium hydroxide.

The other three are aqueous solutions of the same acid but each has a different concentration.

The student carries out further tests to identify the acid and place the three acid solutions in order of concentration.

(a) He is supplied with the chemicals listed.

aqueous barium nitrate
aqueous copper sulfate
aqueous silver nitrate

He **cannot** use any other chemicals or testing materials.

He carries out a test using **one** of the chemicals listed to find out which solution **H**, **J**, **K** or **L** is aqueous sodium hydroxide.

State the chemical he uses to identify **J** as aqueous sodium hydroxide.

Give the observation for this positive test.

test .....

observation .....

[1]

(b) He carries out a controlled test on the three remaining acid solutions using marble chips.

His observations are shown in Fig. 4.1.

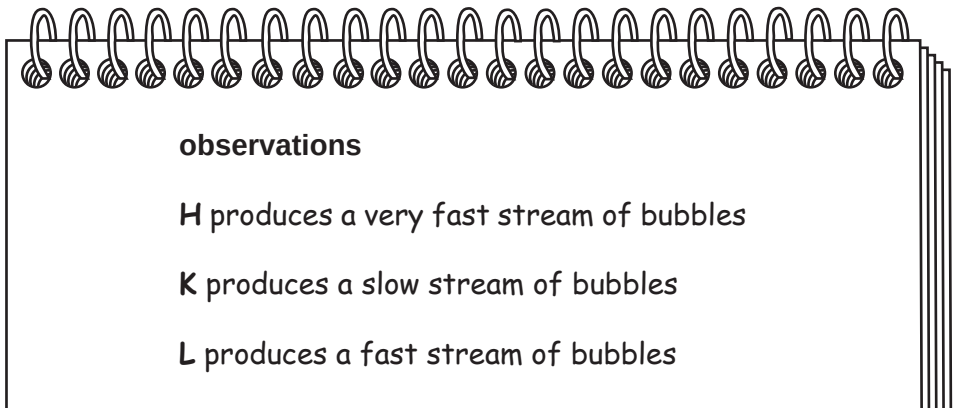

Fig. 4.1

(i) State two variables which must be controlled in this test.

controlled variable 1 .....

controlled variable 2 .....

[2]

(ii) Use the observations in Fig. 4.1 to state the order of concentration of the three acid solutions.

Explain how you use the observations to find the order of the concentrations.

most concentrated acid solution .....

.....

least concentrated acid solution .....

explanation.....

.....

[2]

(c) **H**, **K** and **L** are the same acid.

Describe tests that the student uses to identify the acid.

He uses only chemicals from the list in **(a)**.

Complete Table 4.1 with the chemicals used in the tests, and the observation for a positive test.

Table 4.1

acid	test	observation for a positive test
sulfuric		
hydrochloric		

[3]

[Total: 8]

5 A student determines an approximate value for the specific heat capacity of glass.

The specific heat capacity c of glass is the amount of thermal energy required to raise the temperature of 1 g of glass by 1 °C.

(a) She uses a balance to find the mass m of an empty beaker **P**.

Fig. 5.1 shows the reading on the balance.

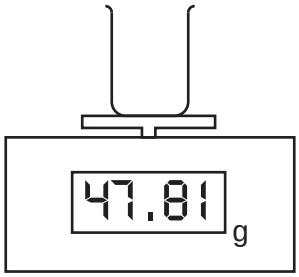

Fig. 5.1

Write down the mass of beaker **P** to the nearest gram.

m = ... g [1]

(b)
- She pours 100 cm^3 of cold water into beaker **P**.
- She measures and records the temperature θ_1 of the cold water to the nearest 0.5 °C.

Fig. 5.2 shows the thermometer reading.

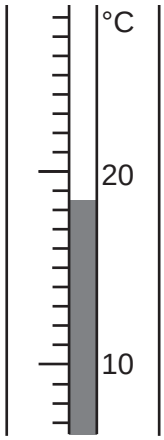

Fig. 5.2

Write down the temperature θ_1 of the cold water.

θ_1 = ... °C [1]

(c)
- She pours 100 cm^3 of hot water into a second beaker **Q**.
- She places the thermometer into the hot water.
- She measures and records the temperature θ_2 of the hot water.

θ_2 = 81.0 °C

- She pours the hot water from beaker **Q** into the cold water in beaker **P**.
- She stirs the mixture.
- She measures and records the temperature θ_3 of the mixture.

θ_3 = 48.0 °C

Explain why she stirs the mixture before recording its temperature.

.....

..... [1]

(d) **(i)** Calculate the rise in temperature $(\theta_3 - \theta_1)$ of the cold water.

$(\theta_3 - \theta_1)$ = ... °C [1]

(ii) Calculate the fall in temperature $(\theta_2 - \theta_3)$ of the hot water.

$(\theta_2 - \theta_3)$ = ... °C [1]

(e) **(i)** Calculate the gain in thermal energy E_c of the cold water. Use the equation shown.

$$E_c = 420 \times (\theta_3 - \theta_1)$$

E_c = ... J [1]

(ii) Calculate the loss in thermal energy E_h of the hot water. Use the equation shown.

$$E_h = 420 \times (\theta_2 - \theta_3)$$

E_h = ... J [1]

(f) The difference between E_h and E_c is approximately equal to the thermal energy E_g gained by the glass beaker **P**.

(i) Use your answers to **(e)(i)** and **(e)(ii)** to calculate the thermal energy gained by the glass. Use the equation shown.

$$E_g = E_h - E_c$$

E_g = ... J [1]

(ii) Use your answers to **(a)**, **(d)(i)** and **(f)(i)** to calculate the specific heat capacity *c* of glass.

Use the equation shown.

$$E_g = m \times c \times (\theta_3 - \theta_1)$$

c = ... J/g °C [2]

(g) State two practical reasons why any value for the specific heat capacity of glass determined using this experiment is not accurate.

reason 1 .....

.....

reason 2 .....

.....

[2]

(h) Suggest **one** improvement to the apparatus that will give a more accurate value for the specific heat capacity of glass.

.....

..... [1]

[Total: 13]

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6 A student investigates how the resistance of a wire depends upon its length.

To calculate resistance he uses the equation shown.

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

The apparatus available is listed.

- power supply
- ammeter
- voltmeter
- switch
- several metres of resistance wires of different materials and thicknesses
- metre rule
- wire cutters
- connecting leads
- crocodile clips
- beaker of cold water

Plan an experiment to investigate how the resistance of the wire depends upon its length.

You **must** select apparatus for your experiment from the list above. You may **not** use any other apparatus.

You are **not** required to carry out this investigation.

Include in your answer:

- a diagram of the circuit you would use
- how you would carry out the experiment
- the key variables you would control
- a table with column headings to show how you would present your results (you are not required to enter any readings in the table)
- how you would use your readings to come to a conclusion.

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..... [7]

[Total: 7]

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