Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

COMBINED SCIENCE **0653/52**

Paper 5 Practical Test **May/June 2019**

1 hour 15 minutes

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	
4	
Total	

This document consists of **11** printed pages and **1** blank page.

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1 You are going to investigate the amount of precipitate formed in two different reactions.

(a) Barium nitrate solution and sodium sulfate solution are both colourless. They react together to form a white precipitate.

Method

A. Label six test-tubes **3**, **4**, **5**, **6**, **7** and **8**. Numbers 1 and 2 have been omitted deliberately.

B. Using a measuring cylinder pour $3\,cm^3$ barium nitrate solution into each test-tube.

C. Using a clean measuring cylinder add $3\,cm^3$ sodium sulfate solution into test-tube **3**. Stir the solution with the glass rod. Rinse the glass rod with distilled water.

D. Add $4\,cm^3$ sodium sulfate solution into test-tube **4**. Stir the solution with the glass rod. Rinse the glass rod with distilled water.

E. Add $5\,cm^3$, $6\,cm^3$, $7\,cm^3$ and $8\,cm^3$ sodium sulfate solution into test-tubes **5**, **6**, **7** and **8** as shown in Table 1.1. Use the glass rod to stir each solution and rinse the glass rod each time with distilled water.

F. Leave the test-tubes to stand for at least six minutes to allow the precipitates to settle.

While you are waiting for the precipitates to settle you should start **(c)**.

G. After six minutes, use a ruler to measure the height in mm of the solid precipitate in each test-tube. Start at test-tube **8**.

Record these heights to the nearest millimetre in Table 1.1.

Table 1.1

test-tube number	volume of sodium sulfate solution added / cm^3	height of precipitate / mm
3	3	
4	4	
5	5	
6	6	
7	7	
8	8	

[2]

(b) Look at the results in **your** experiment in **Table 1.1**.

(i) Describe the relationship between height of precipitate and volume of sodium sulfate solution added.

.... [1]

(ii) The volume of sodium sulfate solution added to the barium nitrate solution continues to be increased.

Predict what happens to the height of the precipitate formed. Explain your answer.

prediction ....

....

explanation ....

....
[2]

(iii) State **two** improvements that could be made to **your** experiment to make the results more accurate. For each improvement explain how it increases the accuracy.

1. improvement ....

explanation ....

....

2. improvement ....

explanation ....

....
[2]

(c) A student performs a similar experiment to that in **(a)** using a fixed volume of copper sulfate solution in the test-tube and adds ammonia solution. A blue precipitate is formed.

Her results are shown in Table 1.2.

Table 1.2

test-tube number	volume of ammonia solution added / cm^3	height of precipitate / mm
1	1	1.1
2	2	2.6
3	3	3.5
4	4	4.6
5	5	3.7
6	6	1.9
7	7	0.1
8	8	0.0

(i) On the grid of Fig. 1.1, plot a graph of the **student's** results in Table 1.2.

Plot the height of precipitate (vertical axis) against volume of ammonia solution added. [3]

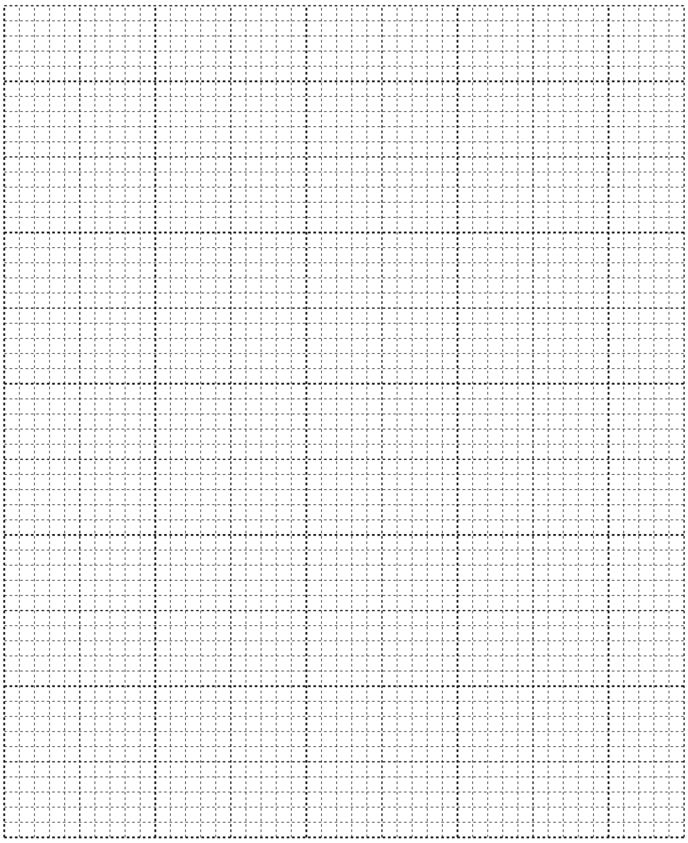

Fig. 1.1

(ii) On Fig. 1.1, draw the best-fit straight line for test-tubes **1**, **2**, **3** and **4**.

On Fig. 1.1, draw a second line of best fit for test-tubes **5**, **6**, **7**, and **8**. [1]

(iii) State the volume of ammonia which needs to be added to form the maximum height of precipitate. This is the point where the two lines of best fit intersect.

volume = ... cm^3 [1]

(iv) Describe and explain what is happening in the test-tubes numbered **5**, **6**, **7** and **8** in the student's experiment.

....

.... [1]

[Total: 13]

2 You are going to investigate the effects of the enzyme pectinase on fruit.

(a) Pectinase is an enzyme that breaks down plant cell walls, and juice is released.

You are provided with two beakers that have been left overnight.

- Beaker **A** contains chopped apple with 5% pectinase solution.
- Beaker **B** contains chopped apple with water.

(i) Explain the purpose of using water instead of pectinase in beaker **B**.

....

.... [1]

(ii) State **two** variables that should have been controlled when beaker **A** and beaker **B** were left overnight.

variable 1 ....

variable 2 ....
[2]

(b) You are going to separate the juice from the chopped apple in beaker **A** and measure the volume of the juice collected after 5 minutes.

- Separate the chopped apple from the juice in beaker **A**.
- At the same time repeat for beaker **B**, using separate apparatus.
- Leave for 5 minutes.

(i) Draw and label the assembled apparatus you used to separate the chopped apple from the juice.

[3]

(ii) After 5 minutes record the volume of apple juice you have collected from beaker **A** and beaker **B**.

volume of juice from beaker **A** = ... cm^3

volume of juice from beaker **B** = ... cm^3
[1]

[Total: 7]

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3 A plant loses water from its leaves through transpiration.

A student states:

A plant in humid air will lose less water than a plant in dry air.

Plan an investigation to test whether this statement is correct.

You are not required to carry out this investigation.

In your answer, include:

- the apparatus needed, including a labelled diagram if you wish
- a brief description of the method, including how you will treat variables and any safety precautions
- the measurements you will make
- how you will process your results
- how you will use your results to draw a conclusion.

[7]

4 You are going to investigate ice melting in a beaker of water.

(a) **(i)** Measure and record the mass m_a of the empty measuring cylinder to the nearest 0.01 g.

m_a = ... g

- Add 100 cm^3 of water to the measuring cylinder.
- Measure and record the mass m_b of the measuring cylinder and water to the nearest 0.01 g.

m_b = ... g
[1]

(ii) Calculate the mass m_w of the 100 cm^3 of water. Use your answers to **(a)(i)** and the equation shown:

$$m_w = m_b - m_a$$

m_w = ... g [1]

(iii) Measure and record the temperature T_i of the water to the nearest 0.5 °C.

T_i = ... °C [1]

(b) **(i)** Take one ice cube and measure and record its mass m_i to the nearest 0.01 g.

m_i = ... g [1]

(ii)
- Pour the water from the measuring cylinder into a beaker.
- Add the ice cube to the beaker of water.
- Immediately start the stop-clock.
- After 3 minutes, stir the water with the glass rod.
- Measure and record the temperature T_f of the water.

T_f = ... °C [1]

(iii)
- Immediately remove the ice cube from the beaker.
- Dry the ice cube with the paper towel provided.
- Measure and record the mass m_f of the ice cube.

m_f = ... g [1]

(iv) Explain how stirring the water improves the accuracy of the temperature measurement.

....

....

.... [1]

(c) **(i)** Calculate the drop in temperature T_d of the water during the experiment. Use your answers to **(a)(iii)** and **(b)(ii)** and the equation shown:

$$T_d = T_i - T_f$$

T_d = ... °C [1]

(ii) Calculate the thermal energy E_l lost by the water. Use your answers to **(a)(ii)** and **(c)(i)** and the equation shown.
Give your answer to a suitable number of significant figures.

$$E_l = m_w \times 4.2 \times T_d$$

E_l = ... J [2]

(d) **(i)** Calculate the mass m_m of ice that melted in the experiment. Use your answers to **(b)(i)** and **(b)(iii)** and the equation shown:

$$m_m = m_i - m_f$$

m_m = ... g [1]

(ii) 334 J of thermal energy is needed to melt 1 g of ice and change it into water.

Calculate the energy E_m used to melt the ice in this experiment. Use your answer to **(d)(i)** and the equation shown:

$$E_m = m_m \times 334$$

E_m = ... J [1]

(e) In this experiment the amount of thermal energy needed to melt the ice cube is greater than the thermal energy lost by the water.

Suggest where the extra energy used to melt the ice comes from.

....

.... [1]

[Total: 13]

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

Flame tests for metal ions

metal ion	flame colour
lithium (Li^+)	red
sodium (Na^+)	yellow
potassium (K^+)	lilac
copper(II) (Cu^{2+})	blue-green