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Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8580263130

COMBINED SCIENCE **0653/52**

Paper 5 Practical Test **February/March 2024**

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	
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1 Penguins stand close together in a huddle, as shown in Fig. 1.1.



Fig. 1.1

You will investigate the effect on heat loss of standing together in a huddle. You will use test-tubes to represent the penguins.

The apparatus is assembled as shown in Fig. 1.2.

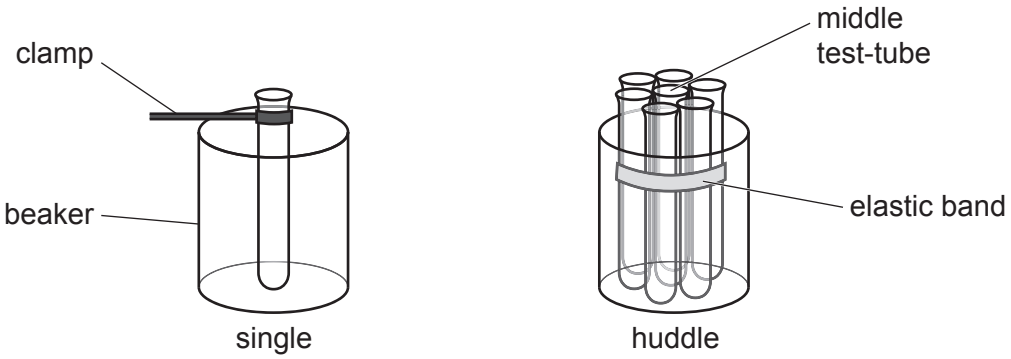


Fig. 1.2

Procedure

Step 1 Fill **all** the test-tubes with hot water.

Step 2 Put a thermometer in the single test-tube.

Step 3 Put another thermometer in the middle test-tube of the huddle.

Step 4 Record in Table 1.1 the temperature of the water in these two test-tubes for time = 0 minutes.

Step 5 Start the stop-clock.

Step 6 Measure the temperature in each of these two test-tubes every minute for a total of 5 minutes.

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(a) **(i)** Record in Table 1.1 the temperature readings.

Table 1.1

time / minutes	temperature / °C	
	single test-tube	middle test-tube
0		
1		
2		
3		
4		
5		

[3]

(ii) Calculate the overall change in temperature for each of the two test-tubes after 5 minutes.

single test-tube = ... °C

middle test-tube = ... °C
[1]

(iii) State a conclusion for your results in **(a)(ii)**.

.....

..... [1]

(b) Suggest why it is better to use the change in temperature to compare the heat loss rather than the final temperature.

.....

..... [1]

(c) In this procedure you investigated the effect on heat loss of standing in a huddle.

Suggest one **other** variable that affects heat loss in penguins.

.....

..... [1]

[Total: 7]

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2 When a person exercises, their pulse rate changes.

Plan an investigation to determine the relationship between the intensity of exercise a person does and the change in their pulse rate.

You may use any common laboratory apparatus.

You are not required to do this investigation.

In your plan, include:

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

You may include a table that can be used to record the results if you wish.
You do **not** need to include any results in your table.

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3 You are going to investigate some properties of solution **H**.

(a) Procedure

Step 1 Measure 10.0 cm^3 of solution **H** using a 10 cm^3 measuring cylinder.

Step 2 Pour this volume of solution **H** into a boiling tube.

Step 3 Measure the temperature of solution **H** to the nearest 0.5 °C.

(i) Record your result in Table 3.1.

Table 3.1

temperature of solution **H** in **step 3** / °C	
highest temperature of mixture at end of **step 5** / °C	
temperature increase / °C	

[1]

Step 4 Add **all** the aluminium foil provided to the boiling tube.

Step 5 Stir the mixture in the boiling tube and measure the highest temperature reached to the nearest 0.5 °C.

(ii) Record your result in Table 3.1. [1]

Step 6 Filter the mixture from the boiling tube into a test-tube.

(iii) Describe the appearance of the residue in the filter paper and the filtrate in the test-tube.

residue .....

filtrate .....

[2]

(iv) Calculate the temperature increase between **step 3** and **step 5**.

Record your answer in Table 3.1. [1]

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(v) Calculate the amount of thermal (heat) energy released q.

Use the equation shown.

$$q = 10.0 \times 3.96 \times \text{temperature increase}$$

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

thermal energy released q = ... J [2]

(vi) Explain why the reaction mixture is stirred in **step 5**.

.....

..... [1]

(vii) The temperature increase is **not** as large as expected because thermal (heat) energy is transferred to the surroundings.

Suggest **one** improvement to the apparatus that will give a more accurate value for the thermal energy released.

.....

..... [1]

(b) Procedure

- Add approximately 1 cm depth of solution **H** to a test-tube.
- Slowly add aqueous ammonia to the test-tube until there is no further change.

Record your observations.

.....

.....

..... [2]

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(c) Procedure

- Add approximately 2 cm depth of solution **H** to a test-tube.
- Add approximately 1 cm depth of dilute nitric acid to the test-tube.
- Add five drops of aqueous silver nitrate to the test-tube.
- Leave for 3 minutes.

(i) Record your observations.

.....

..... [1]

(ii) State the name of the salt dissolved in solution **H**.

Use information from your observations in **(b)** and **(c)(i).**

..... [1]

[Total: 13]

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4 You will investigate how the resistance R of a resistance wire varies with its length l.

The circuit is assembled as shown in Fig. 4.1.

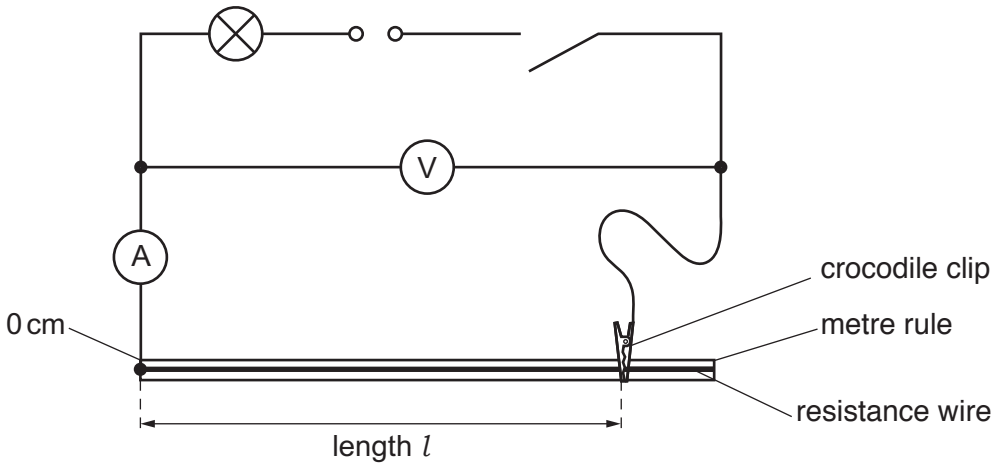


Fig. 4.1

(a) Procedure

- Close the switch.
- Place the crocodile clip on the resistance wire at a length l = 15.0 cm from the 0 cm end of the metre rule.
- Measure the current I in the circuit and the potential difference V across the resistance wire.
- Open the switch.

(i) Record your results in Table 4.1.

Table 4.1

length l of resistance wire / cm	current I / A	potential difference V / V	resistance R / Ω
15.0			
30.0			
45.0			
60.0			
75.0			

[2]

Repeat the procedure in **(a)** for the values of length l shown in Table 4.1.

(ii) Record your results in Table 4.1. [2]

(b) Calculate the resistance R of the wire for each length l.

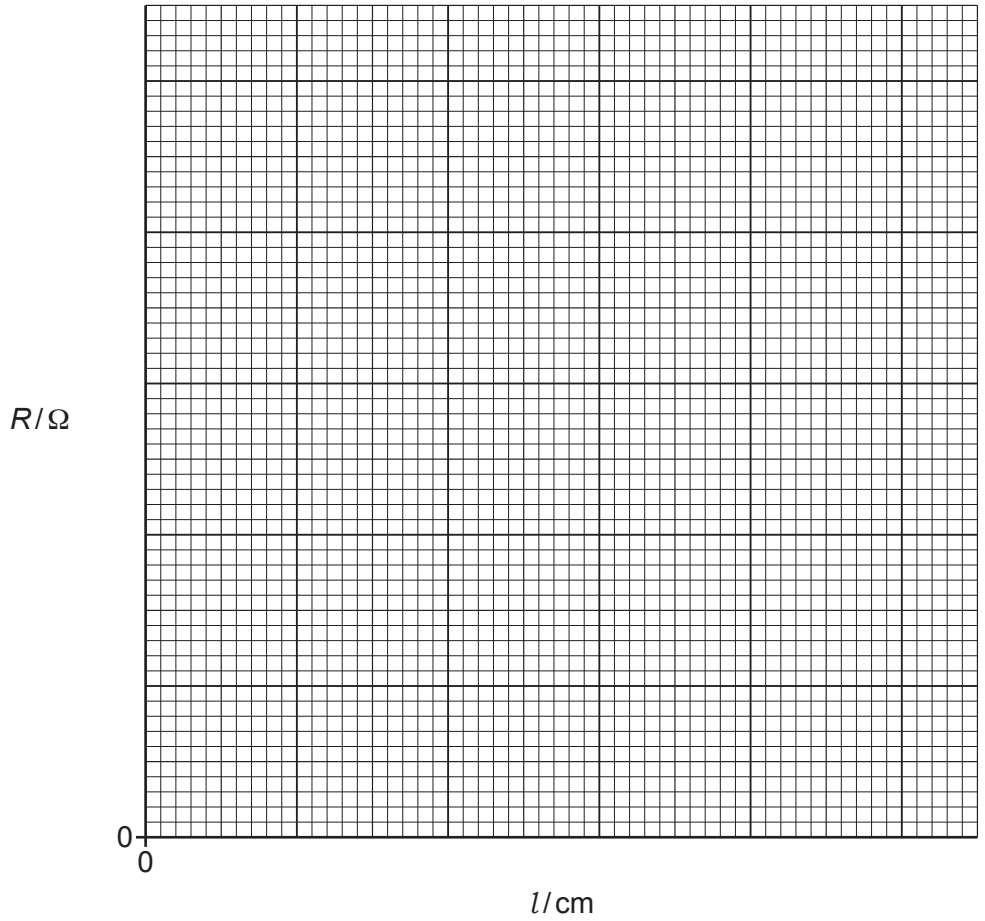
Use the equation shown.

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

Record your values of R in Table 4.1. [2]

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(c) **(i)** On the grid, plot a graph of the resistance R on the vertical axis against length l.



[2]

(ii) Draw the straight line of best fit. [1]

(iii) Calculate the gradient of the line.

Show on your graph the triangle you use to calculate the gradient.

gradient = ... [2]

(iv) The gradient of the line is a measure of the resistance per unit length of the wire.

State the unit for the resistance per unit length of the wire.

unit = ... [1]

(d) Another student repeats the same procedure carefully.

Suggest **one** practical source of error to explain why the other student may get measurements that are different to yours.

.....

..... [1]

[Total: 13]

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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(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

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

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