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Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER							CANDIDATE NUMBER					

* 0 0 7 1 9 4 0 2 3 9 *

CO-ORDINATED SCIENCES **0654/52**

Paper 5 Practical Test **February/March 2025**

2 hours

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 60.
- 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	
5	
6	
Total	

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

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1 You are going to investigate the loss of thermal energy from a large animal and from a small animal using a boiling tube and a test-tube to represent the animals.

(a) Procedure

- Add the hot water provided to the boiling tube up to the line marked. Take care not to spill the water.
- Place a thermometer in the hot water in the boiling tube.
- Wait until the reading on the thermometer stops rising. Record in Table 1.1 the temperature to the nearest 0.5 °C for time = 0.
- Start the stop-clock.
- Record in Table 1.1, the temperature of the water to the nearest 0.5 °C every minute for 5 minutes.

Repeat the procedure using the test-tube instead of the boiling tube.

Table 1.1

time / minutes	temperature of water in boiling tube / °C	temperature of water in test-tube / °C
0		
1		
2		
3		
4		
5		

[5]

(b) (i) You are going to plot both sets of data in Table 1.1 on the same grid.

On the grid:

- plot temperature of water in the boiling tube (vertical axis) against time
- draw the curve of best fit and label this curve L
- plot temperature of water (vertical axis) against time for the test-tube
- draw the curve of best fit and label this curve S.

[5]

(ii) Use your graph to estimate the temperature of the water in the boiling tube at 1.5 minutes.

temperature = ... °C [1]

(c) **(i)** Calculate the decrease in temperature for the water in each tube between the start and at 5 minutes.

boiling tube .... °C

test-tube .... °C
[1]

(ii) Use your results to suggest how the rate of loss of thermal energy from a large animal compares to the rate of loss of thermal energy from a small animal.

....

.... [1]

(d) Explain why repeating the procedure increases confidence in the results.

....

.... [1]

[Total: 14]

2 **(a)** You are provided with two leaves, **A** and **B**, each on a white tile.
The leaves are from the same species of plant.

The green chlorophyll is already removed from each leaf.

(i) Add a few drops of iodine solution to cover the upper surface of each leaf.
State the colour of the iodine solution on each leaf.

leaf **A** ....

leaf **B** ....

[2]

(ii) State a conclusion for your observations in **(a)(i)**.

leaf **A** ....

leaf **B** ....

[1]

(iii) Leaf **A** is from a plant grown in the light for 2 days.
Leaf **B** is from a plant grown in the dark for 2 days.

Explain your conclusion in **(a)(ii)**.

....

....

....

.... [1]

(b) **(i)** Suggest why chlorophyll is removed from each leaf.

....

.... [1]

(ii) Describe how chlorophyll is removed from each leaf.

....

....

.... [1]

[Total: 6]

3 You are going to identify solid **J** and the ions present in solid **K** and in aqueous **L**.

Solid **K** and aqueous **L** contain the same cation.

(a) Describe the appearance of **J**.

....

.... [1]

(b) Read all of the procedure in **(b)** before you begin, as you need to test the gas given off and identify it.

Procedure

- Measure 10 cm^3 of water using a measuring cylinder.
- Pour the water into a boiling tube.
- Add the small pieces of solid **J** to the water.
- Test to identify the gas given off.

(i) Describe what happens when **J** is added to water.

....

....

.... [2]

(ii) test ....

observation ....

identity of gas ....

[2]

(c) **Procedure**

- Remove the stopper from one of the boiling tubes of carbon dioxide.
- Pour the solution from **(b)(i)** into the boiling tube of carbon dioxide.
- **Quickly** replace the stopper and shake.

Describe what happens to the solution.

Identify the solution from **(b)(i)**.

description ....

identity of solution ....

[1]

(d) **Procedure**

- Measure 10 cm^3 of water using a measuring cylinder.
- Pour the water into a boiling tube and leave to stand.
- Put two spatula loads of solid **K** into a clean dry hard glass test-tube.
- Hold the hard glass test-tube with a test-tube holder and heat solid **K** for about two minutes.
- Pour the solid in the hard glass test-tube into the water in the boiling tube.
- Stir the mixture in the boiling tube using the glass rod and wait until any solid settles to the bottom of the tube.
- Remove the stopper from another boiling tube of carbon dioxide.
- Pour the solution into the boiling tube containing carbon dioxide.
- Quickly replace the stopper and shake the boiling tube.

Describe what happens to the solution.

Identify the solution formed.

description ....

identity ....
[1]

(e) **Procedure**

- Put approximately 2 cm depth of aqueous **L** into a test-tube.
- Slowly add aqueous sodium hydroxide until it is in excess.

Describe your observations.

....

.... [1]

(f) Identify the cation present in both solid **K** and aqueous **L**.

Identify solid **J**.

cation in **K** and **L** ....

J is ....
[1]

(g) Do tests to confirm the identity of the anion in aqueous **L**.

Describe the test which gives the observation for a positive result and identify the ion.

test ....

observation ....

ion ....
[2]

(h) Flame tests are often used to identify metal ions.

State **two** reasons why a flame test is done using a blue flame rather than a yellow one.

reason 1 ....

....

reason 2 ....

....

[2]

[Total: 13]

4 When ammonium sulfate is heated with sodium hydroxide, it reacts to form ammonia gas.

Ammonia gas is **not** collected over water because it is soluble in water.

Plan an investigation to find the relationship between the mass of ammonium sulfate used and the volume of ammonia gas made.

You are provided with:

- aqueous sodium hydroxide
- ammonium sulfate powder.

You may use any common laboratory apparatus.

You are **not** required to do this investigation.

Include in your plan:

- the apparatus you will need and an explanation of any safety precautions
- a brief description of the method
- the measurements you will make and how you make them as valid as possible
- the variables you will control
- how you will process your results to draw a conclusion.

You may include a labelled diagram if you wish.

You may include a results table if you wish, you are not required to enter any readings in the table.

[7]

5 You are going to investigate how the stability of a plastic bottle depends on the height of the water in the bottle.

Fig. 5.1 shows the apparatus you will use and where the bottle will be pushed.

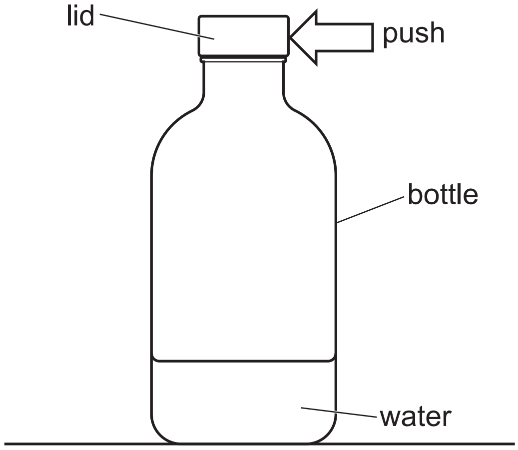

Fig. 5.1

(a) (i) You are provided with a plastic bottle containing water.

Measure the height of the water in the bottle.

Record your answer in Table 5.1.

Table 5.1

height of water in the bottle / cm	angle θ / °
10	
15	
20	
25	

[1]

(ii) Procedure

- Gently push sideways at the top of the bottle as shown in Fig. 5.1.
- Push the bottle until you find the point where it will **just** start to fall over without you pushing any more.
  The angle θ is the angle between the bottle and the table as the bottle **just** starts to fall over as shown in Fig. 5.2.

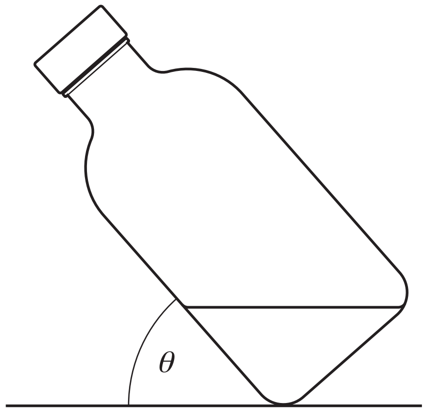

Fig. 5.2

- Use the protractor to measure angle θ.
- Record angle θ in Table 5.1.

[1]

(iii) Repeat the procedure using the heights of water in the bottle shown in Table 5.1. Each time fill the bottle to the height on Table 5.1 and put the lid back on. [2]

(b) Describe the relationship between the height of water in the bottle and angle θ.

....

.... [1]

(c) It is difficult to measure angle θ.

Suggest how to overcome this difficulty.

....

.... [1]

(d) Another student repeats the procedure using the same apparatus.
The bottle falls over at an angle θ of 70°.

Estimate the height of water in the bottle.
Use your results in Table 5.1.

height .... cm [1]

[Total: 7]

6 You are going to determine the density of modelling clay using two different methods.

You are provided with a piece of modelling clay.

(a) Method 1

(i) Make your modelling clay into a rough cuboid as shown in Fig. 6.1.

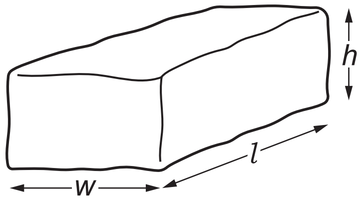

Fig. 6.1

Record the dimensions l, w and h of your cuboid in cm to the nearest 0.1 cm.

l = ... cm

w = ... cm

h = ... cm
[2]

(ii) Calculate the volume V_1 of the modelling clay.

Use the equation shown.

$$V_1 = l \times w \times h$$

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

V_1 = ... cm^3 [2]

(iii) Use a balance to measure the mass m of the modelling clay.
Record your value to the nearest 0.1 g.

m = ... g [1]

(iv) Calculate the density ρ_1 of the modelling clay.

Use the equation shown.

$$\rho_1 = \frac{m}{V_1}$$

ρ_1 = ... g/cm^3 [1]

(v) Describe **one** reason why your measurements of the dimensions in **(a)(i)** are **not** accurate.

....

.... [1]

(b) Method 2

(i) Approximately half-fill the measuring cylinder with water.

Record the volume V_2 of water in cm^3 to the nearest cm^3.

V_2 = ... cm^3

Shape the modelling clay used in method 1 so that it fits into the measuring cylinder.

Carefully lower the modelling clay into the water so that it is completely below the surface of the water.

The reading on the measuring cylinder is V_3.
Record V_3 in cm^3 to the nearest cm^3.

V_3 = ... cm^3
[1]

(ii) Calculate the volume V_c of the modelling clay.

Use the equation shown.

$$V_c = V_3 - V_2$$

V_c = ... cm^3 [1]

(iii) Calculate the density ρ_2 of the modelling clay.

Use the value of m from **(a)(iii)**.

ρ_2 = ... g/cm^3 [1]

(c) (i) It is more accurate to do **method 1** before **method 2** to determine the density of the modelling clay.

Explain why it is more accurate.

....

.... [1]

(ii) Two values are considered to be equal within the limits of experimental error if the difference between them is less than 10%.

Explain if your values of ρ_1 and ρ_2 are considered equal within the limits of experimental error.

Justify your answer with a calculation.

....

....

.... [1]

(iii) Another student repeats the procedure in **method 2**.

The student spills some of the water from the measuring cylinder when they lower the modelling clay into the water.

Suggest what effect this has on the calculated value of density.

Explain your answer.

suggestion ....

explanation ....

....

[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, then test for carbon dioxide gas	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.
iodide, I^- [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	yellow ppt.
nitrate, NO_3^- [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate, SO_4^{2-} [in solution]	acidify with dilute nitric acid, 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, ppt. turns brown near surface on standing	green ppt., insoluble in excess, ppt. turns brown near surface on standing
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