Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

7574203137

COMBINED SCIENCE **0653/52**

Paper 5 Practical Test **May/June 2022**

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.

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1 (a) Water moves into a cell by osmosis.

You are going to investigate the effect of temperature on the movement of water by osmosis.

You will use a dialysis tubing bag as a model cell.

You are provided with a glucose solution and two dialysis tubing bags. The dialysis tubing bags are provided in distilled water ready to use.

Procedure

Step 1 Label one boiling tube (large test-tube) **C** and a second boiling tube **H**.

Step 2 Use a syringe to put 10 cm^3 of glucose solution into one of the dialysis tubing bags.

Step 3 Tie a knot in the top of the dialysis tubing bag, as shown in Fig. 1.1.

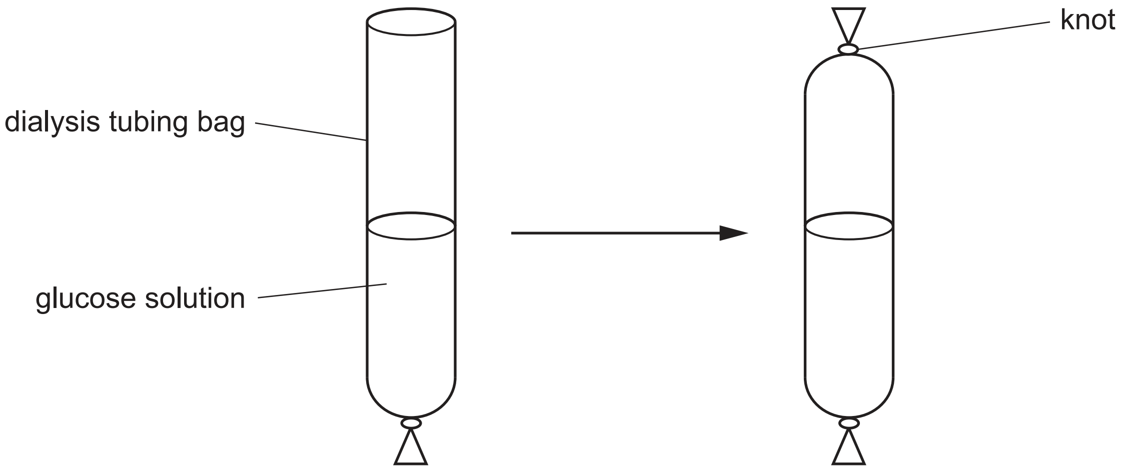

Fig. 1.1

Step 4 Place the filled dialysis tubing bag into boiling tube **C**.

Step 5 Repeat **Step 2** to **Step 4** with the second dialysis tubing bag, placing it into boiling tube **H**.

Step 6 Remove the dialysis tubing bag from boiling tube **C** and measure its **initial** mass. Then put the dialysis tubing bag back into boiling tube **C**.

Step 7 Remove the dialysis tubing bag from boiling tube **H** and measure its **initial** mass. Then put the dialysis tubing bag back into boiling tube **H**.

(i) Record in Table 1.1 the **initial** mass of each dialysis tubing bag. [2]

Table 1.1

dialysis tubing bag in boiling tube	**initial** mass / g	**final** mass / g	change in mass / g
C			
H			

Step 8 Add enough distilled water to both boiling tubes so that the dialysis tubing bags are fully covered.

Step 9 Place boiling tube **C** into the beaker of cold water labelled **cold**.

Step 10 Place boiling tube **H** into the beaker of hot water labelled **hot**.

Step 11 Start a stop-clock and leave the beakers for 10 minutes.

While waiting you can start question **1(b)**.

Step 12 After the 10 minutes, remove the dialysis tubing bag from boiling tube **C** and dry it with a paper towel. Leave the dialysis tubing bag on the paper towel and label the towel **C**.

Step 13 Remove the dialysis tubing bag from boiling tube **H** and dry it with a paper towel. Leave the dialysis tubing bag on the paper towel and label the towel **H**.

Step 14 Measure the **final** mass of each dialysis tubing bag.

(ii) Record in Table 1.1 the **final** mass of each dialysis tubing bag. [2]

(iii) Calculate the **change in mass** for each dialysis tubing bag. Record your answers in Table 1.1. [1]

(iv) Describe the effect of temperature on the mass of water entering the dialysis tubing bags.

....

.... [1]

(v) Explain why the dialysis tubing bags are dried in **Step 12** and **Step 13**.

....

.... [1]

(b) You are provided with a slice of citrus fruit. The slice of citrus fruit has an inner flesh part and an outer skin part.

(i) Measure the diameter of the slice of fruit.

Record your answer in millimetres to the nearest millimetre.

diameter of slice of fruit = ... mm [1]

(ii) In the box provided, make a large, clear pencil drawing of the slice of fruit.

[3]

(iii) Measure the diameter of your drawing in **(b)(ii)**.

Record your answer in millimetres to the nearest millimetre.

diameter of your drawing = ... mm [1]

(iv) Calculate the magnification of your drawing.

Use the equation shown.

$$\text{magnification} = \frac{\text{diameter of your drawing}}{\text{diameter of slice of fruit}}$$

magnification = ... [1]

[Total: 13]

2 You are going to investigate the solubility in water of five substances, **L**, **M**, **N**, **P** and **Q**.

(a) (i) Procedure

- Half-fill a clean test-tube with distilled water.
- Add all of solid **L** to the water.
- Stir the mixture of **L** and water with a stirring rod for 30 seconds.
- Record in Table 2.1 your observations.

Repeat the procedure with solids **M** and **N**.

The observations for solid **P** are shown in Table 2.1.

Table 2.1

solid	observations
L	
M	
N	
P	green solid in a colourless liquid

[3]

(ii) State which solids, **L**, **M**, **N** or **P** are insoluble in water.

.... [1]

(b) Procedure

- Half-fill the beaker labelled **C** with cold tap water.
- Add 10.0 cm^3 of distilled water to the boiling tube containing **Q**.
- Raise your hand and request a beaker labelled **H** containing very hot water.
- Use a test-tube holder to place the boiling tube of **Q** and water into the beaker labelled **H**.
- Stir the mixture of **Q** and water with a thermometer until it dissolves.
- Remove the boiling tube with the solution from the beaker **H**.
- Place the boiling tube with the solution into the beaker labelled **C**.
- Stir the solution with the thermometer and look carefully at the inside of the boiling tube.
- Record, to the nearest 0.5 °C, the temperature when the first crystals of **Q** appear in the boiling tube.

temperature when first crystals appear = ... °C [2]

(c) A student repeats the procedure in **(b)** but cools the boiling tube with the solution in **air** instead of in cold water.

Suggest why cooling the solution in air will give a more accurate temperature for when the first crystals appear.

....

.... [1]

(d) A student repeats the procedure in **(b)** using different masses of **Q**.

The results are shown in Table 2.2.

Table 2.2

mass of **Q** in solution /g	temperature when first crystals of **Q** appear /°C
5	8
10	30
15	50
20	65
25	75

(i) On the grid, plot a graph of the temperature when first crystals of **Q** appear (vertical axis) against the mass of **Q** in solution.

[3]

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

(iii) Describe the relationship between the mass of **Q** in the solution and the temperature when the first crystals appear.

....

.... [1]

(iv) Use the temperature you recorded in **(b)** and your graph to estimate the mass of **Q** used in the procedure in **(b)**.

mass of **Q** = ... g [1]

[Total: 13]

3 You are going to investigate thermal energy changes in water.

(a) Procedure

- Add 150 cm^3 of water at room temperature to the large beaker.
- Record in Table 3.1 the temperature of the water to the nearest 0.5 °C.
- Raise your hand to request 50 cm^3 of very hot water.
- Record in Table 3.1 the temperature of the very hot water to the nearest 0.5 °C.
- Immediately pour the very hot water from the small beaker into the water in the large beaker.
- Stir the water.
- Record in Table 3.1 the final temperature of the mixture of water in the large beaker to the nearest 0.5 °C.

Table 3.1

	volume of water / cm^3	temperature / °C
water at room temperature	150	
very hot water	50	
mixture	200	

[3]

(b) (i) Calculate,

- the difference in temperature between the water at room temperature and the final mixture, ΔT_R
- the difference in temperature between the very hot water and the final mixture, ΔT_H.

Record your answers in Table 3.2.

Table 3.2

ΔT_R / °C	ΔT_H / °C

[1]

(ii) Calculate the increase in thermal energy ΔE_R of the water at room temperature.

Use the equation shown.

$$\Delta E_R = 630 \times \Delta T_R$$

ΔE_R = ... J [1]

(iii) Calculate the decrease in thermal energy ΔE_H of the very hot water.

Use the equation shown.

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

$$\Delta E_H = 210 \times \Delta T_H$$

ΔE_H = ... J [1]

(c) A student suggests that the increase in thermal energy ΔE_R of the water at room temperature should be equal to the decrease in thermal energy ΔE_H of the very hot water.

Suggest **one** reason why your answers to **(b)(ii)** and **(b)(iii)** are **not** equal.

....

.... [1]

[Total: 7]

4 Fig. 4.1 shows a door, hinged at one side. The door can be pulled open by applying a force to the metal ring at any point along the bar **AB**.

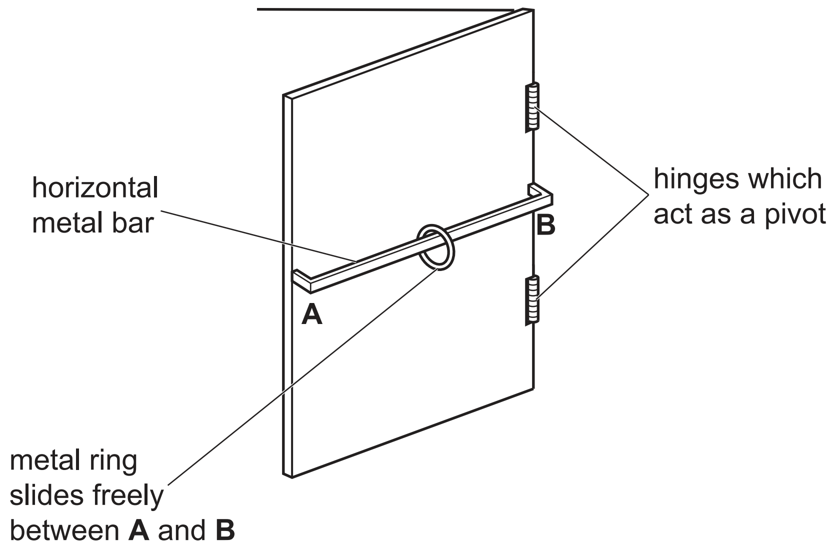

Fig. 4.1

Plan an investigation to find out how the size of the force needed to just open the door varies with the distance of the force away from **B**.

You are given the apparatus in Fig. 4.1 and 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 and the variables you will control
- a results table to record the measurements
- how you will process your results to draw a conclusion.

You are not required to include any results in your results table.

You may include a labelled diagram if you wish.

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.... [7]

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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