Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **0653/62**

Paper 6 Alternative to Practical **October/November 2022**

1 hour

You must answer on the question paper.

No additional materials are needed.

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 [ ].

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

DC (CJ/CB) 307898/2

1 A student investigates the effect of concentration of salt solution on osmosis in potatoes.

Procedure

The student:

step 1 cuts five pieces of potato, each having the shape shown in Fig. 1.1

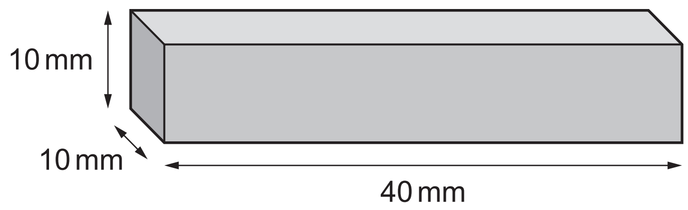

Fig. 1.1

step 2 measures the **initial** mass of each piece of potato and records the values in Table 1.1

step 3 puts one piece of potato into each of five different concentrations of salt solution (10.0%, 7.5%, 5.0%, 2.5% and 0.0%)

step 4 leaves the pieces of potato in the salt solutions for 24 hours

step 5 removes the pieces of potato from the salt solutions and dries them with a paper towel

step 6 measures the **final** mass of each piece of potato and records these values in Table 1.1.

Table 1.1

percentage concentration of salt solution	initial mass / g	final mass / g	change in mass / g
10.0	10.1	6.6	–3.5
7.5	9.9	6.7	–3.2
5.0	10.0	10.0	0.0
2.5	10.0		
0.0	10.1	12.8	+2.7

(a) Fig. 1.2 shows the **final** mass reading on the balance for the piece of potato removed from the 2.5% salt solution.

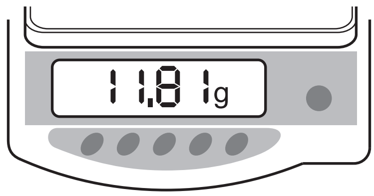

Fig. 1.2

(i) Record in Table 1.1 this reading to **one** decimal place. [1]

(ii) Calculate the change in mass for the piece of potato removed from the 2.5% salt solution.

Use the equation shown.

change in mass = final mass – initial mass

Record this value in Table 1.1. [1]

(b) Water moves into and out of the pieces of potato by osmosis.

- If more water moves **into** a piece of potato than out of it, the piece of potato gains mass.
- If more water moves **out of** a piece of potato than into it, the piece of potato loses mass.

(i) Circle the percentage concentrations of salt solution where more water moves **out of** the piece of potato than into it.

10.0 7.5 5.0 2.5 0.0

[2]

(ii) Suggest what the student observes about the **volume** of the piece of potato removed from the 10.0% salt solution.

.... [1]

(c) Suggest why the student dries the pieces of potato before measuring their final mass.

....

.... [1]

(d) The student repeats the procedure two more times.

Explain why repeating the procedure gives more confidence in the results.

....

.... [1]

[Total: 7]

2 The pulse rate of a person increases during exercise.

After exercise, the pulse rate returns to its normal (resting) level.

The time taken for the pulse rate to return to its resting level is known as the recovery time.

Plan an investigation to determine the relationship between recovery time and the age of a person.

You may use any common laboratory apparatus in your plan.

Include in your plan:

- the apparatus you will use
- a brief description of the method, explaining 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 results table (you are not required to enter any readings in the table).

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.... [7]

3 A student investigates some properties of sodium carbonate.

(a) The student measures the temperature change when solid sodium carbonate dissolves in water.

Procedure

The student:

- adds distilled water to a beaker
- measures the temperature of the water
- adds some solid sodium carbonate to the water
- stirs the mixture until all the sodium carbonate dissolves
- measures the temperature of the solution.

Fig. 3.1 shows the two temperature readings.

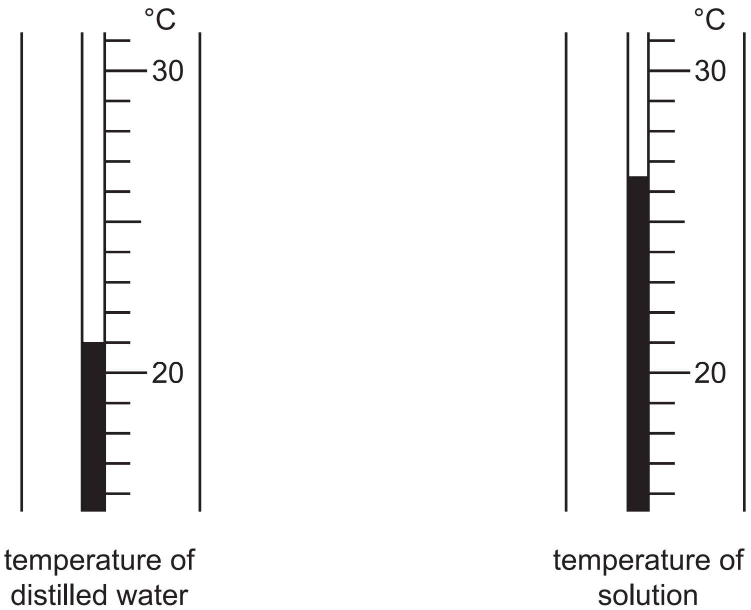

Fig. 3.1

(i) Record in Table 3.1 these two temperature readings to the nearest 0.5 °C. [2]

Table 3.1

temperature of distilled water / °C	
temperature of solution / °C	
temperature change / °C	

(ii) Calculate the temperature change. Use the equation shown.

temperature change = temperature of solution − temperature of distilled water

Record your answer in Table 3.1. [1]

(b) The student measures the pH of aqueous sodium carbonate.

Procedure

The student:

- adds three drops of universal indicator to aqueous sodium carbonate.

The universal indicator turns a blue-purple colour.

Fig. 3.2 shows a pH colour chart.

colour	red	orange	yellow	green	dark green	blue	purple
pH	1	4	6	7	8	10	14

Fig. 3.2

Estimate the pH of the aqueous sodium carbonate using the colour chart in Fig. 3.2.

.... [1]

(c) The student investigates the time it takes for solid sodium carbonate to completely react with dilute hydrochloric acid.

Procedure

The student:

- puts 25.0 cm^3 of dilute hydrochloric acid into a beaker
- adds 0.5 g of solid sodium carbonate to the dilute hydrochloric acid and immediately starts a timer
- stirs the reaction mixture
- stops the timer when the mixture stops fizzing
- records in Table 3.2 the reaction time to the nearest second.

The student repeats the procedure using different masses of sodium carbonate.

The results are shown in Table 3.2.

Table 3.2

mass of sodium carbonate / g	reaction time / s
0.5	31
1.0	63
1.5	91.5
2.0	120
2.5	151

(i) The student records one of the reaction times incorrectly.

Circle the incorrect value in Table 3.2.

Describe how this reaction time is recorded incorrectly.

....

.... [1]

(ii) Explain why it is important to stir the reaction mixture.

....

.... [1]

(iii) Describe the relationship between mass of sodium carbonate and reaction time.

....

.... [1]

(iv) The rate of reaction is calculated using the equation shown.

$$\text{rate} = \frac{\text{mass of sodium carbonate}}{\text{reaction time}}$$

Calculate the rate of reaction when 2.0 g of sodium carbonate is used.

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

rate of reaction = ... g / s [2]

(v) The gas given off is carbon dioxide.

Describe the test for carbon dioxide. Include the observation for a positive result.

test ....

observation ....
[1]

(d) The student is given a sample of a white solid.

The student tests the sample using a flame test.

The sample gives a lilac flame colour.

(i) Describe how to do a flame test.

You may include a labelled diagram in your answer.

....

....

....
[2]

(ii) The student concludes that the sample is **not** sodium carbonate.

Explain how the results from the flame test support this conclusion.

....

.... [1]

[Total: 13]

4 A student makes a toy parachute by attaching a paper circle to an object using four cotton threads.

Fig. 4.1 shows the design.

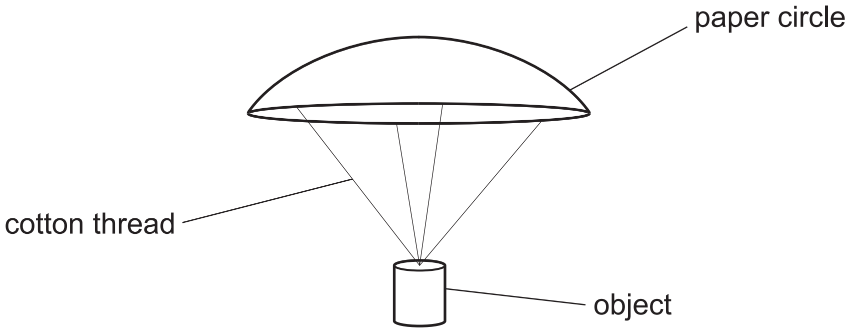

Fig. 4.1

The student investigates the relationship between the size of the paper circle and the time it takes for the parachute to fall to the ground.

Procedure

The student:

- attaches a paper circle of radius r = 4.0 cm to the object
- releases the parachute from a height h above the ground
- measures the time it takes the object to fall to the ground
- records this value in Table 4.1 as test 1
- repeats the test two times (test 2 and test 3).

The student repeats the procedure with paper circles of radius r = 8.5 cm, 10.0 cm, 12.5 cm and 18.0 cm.

(a) Table 4.1 shows the results of the investigation.

The table is not complete.

Table 4.1

r / cm	r^2 / cm^2	time to fall to the ground / s			
		test 1	test 2	test 3	average
4.0	16	4.4	4.1	4.2	4.2
8.5	72	7.1	7.0	6.9	7.0
10.0	100	9.6	9.9	9.7	9.7
12.5	156	19.1	13.5	13.3	13.4
18.0		21.2	20.8		

(i) Calculate the value of r^2 for the parachute with r = 18.0 cm.

Record this value in Table 4.1. [1]

(ii) Fig. 4.2 shows the stop-watch reading for test 3 of the 18.0 cm parachute.

Fig. 4.2

Record in Table 4.1 this reading to the nearest 0.1 s. [1]

(iii) Calculate the average time for the parachute with r = 18.0 cm.

Record in Table 4.1 this value to the nearest 0.1 s. [2]

(b) One of the tests for the parachute with r = 12.5 cm has an anomalous result for time.

(i) Circle the value of this anomalous result for time in Table 4.1. [1]

(ii) Suggest what might cause an anomalous result like this.

....

.... [1]

(c) **(i)** On the grid, plot a graph of average time (vertical axis) against r^2 using the data in Table 4.1.

[3]

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

(iii) State the relationship between average time and r^2.

....

.... [1]

(d) The student decides to make another parachute using a paper circle with a radius smaller than 4.0 cm.

Fig. 4.3 shows this paper circle, drawn full size.

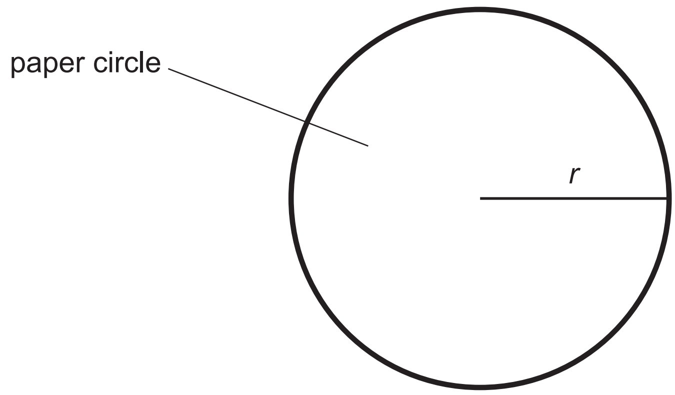

Fig. 4.3

(i) Use a ruler to measure the radius of this circle to the nearest 0.1 cm.

r = ... cm [1]

(ii) Suggest **one** difficulty of testing a parachute made from a paper circle with a radius this small.

....

.... [1]

[Total: 13]

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