Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

5217098753

COMBINED SCIENCE **0653/62**

Paper 6 Alternative to Practical **October/November 2021**

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.

1 A student investigates the effect of concentration of salt solution on the movement of water into and out of a potato.

(a) Procedure

The student:

- cuts five identical samples of the potato with the dimensions shown in Fig. 1.1

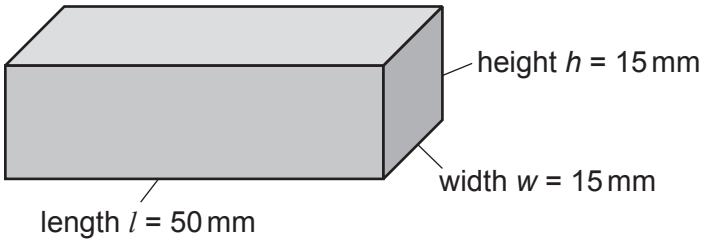


Fig. 1.1

- prepares five different percentage concentrations of salt solution in separate beakers
- places one sample of potato in each beaker of salt solution for 30 minutes
- removes the potato samples and dries them
- measures the new length, height and width of each sample of potato and records the values in Table 1.1.

(i) The actual size of the sample of potato removed from the 1% salt solution is shown in Fig. 1.2.

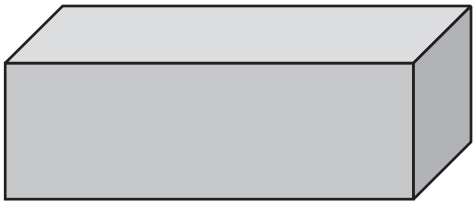


Fig. 1.2

Measure the length l and the height h of the sample of potato in Fig. 1.2 and record these values in Table 1.1.

Table 1.1

percentage salt solution	length l / mm	height h / mm	width w / mm	volume V / mm^3
1			18	
2	51	15	16	12000
3	48	14	14	9400
4	47	13	13	7900
5	46	13	12	7200

[2]

(ii) Calculate the volume V for the sample of potato removed from the 1% salt solution.

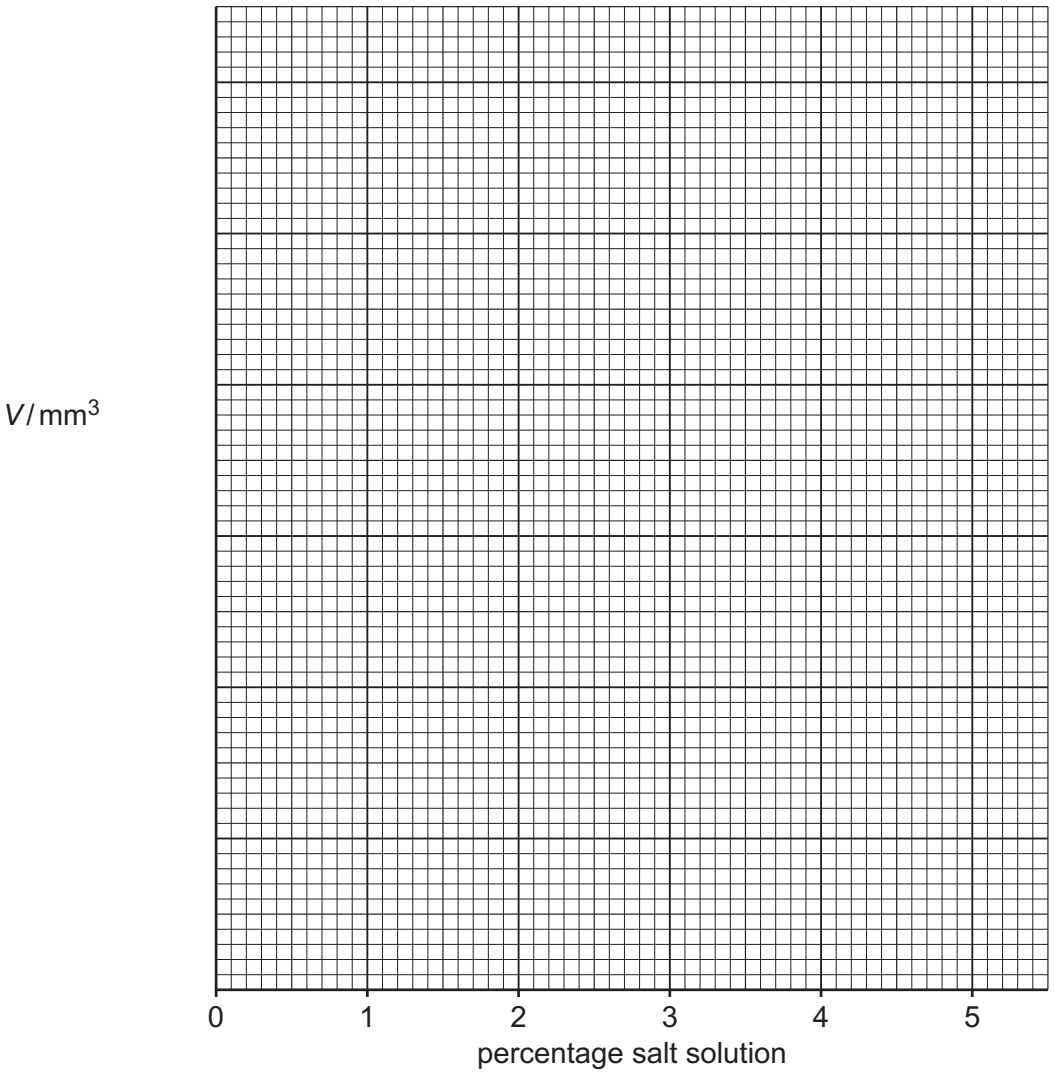
Use the equation shown.

$$V = l \times h \times w$$

Record in Table 1.1 this value to **two** significant figures. [2]

(iii) Use the data in Table 1.1 to plot a graph of volume V against percentage salt solution.

Use a suitable scale for the volume axis. You do **not** need to start the scale at zero.



[2]

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

(v) Use your graph to estimate the volume of a sample of potato removed after 30 minutes from a 3.5% salt solution.

Show on your graph how you obtain your answer.

volume = ... mm^3 [2]

(b) The student repeats the procedure using **three** samples of potato in each concentration of salt solution.

Explain how this improves the investigation.

.....

..... [1]

(c) Fig. 1.3 shows a photograph of part of a potato plant.

Fig. 1.3

In the box, make a large detailed drawing of the part of the potato plant shown in the photograph in Fig. 1.3.

[3]

[Total: 13]

2 A student prepares a sample of a salt by neutralising aqueous sodium hydroxide with dilute sulfuric acid.

It is important that the aqueous sodium hydroxide is neutralised by the correct amount of dilute sulfuric acid.

Aqueous sodium hydroxide and dilute sulfuric acid are both corrosive.

(a) Procedure

The student:

step 1 fills a burette with dilute sulfuric acid

step 2 records in Table 2.1 the initial reading of dilute sulfuric acid in the burette

step 3 adds 25.0 cm^3 of aqueous sodium hydroxide to a conical flask

step 4 puts three drops of litmus indicator into the aqueous sodium hydroxide

step 5 slowly adds the dilute sulfuric acid to the aqueous sodium hydroxide

step 6 stops adding the dilute sulfuric acid as soon as the litmus changes from blue to red

step 7 records in Table 2.1 the reading of dilute sulfuric acid in the burette

step 8 keeps the red solution in the flask for step 9 in **(b)**.

(i) Explain why it is important that the student wears safety goggles during the procedure.

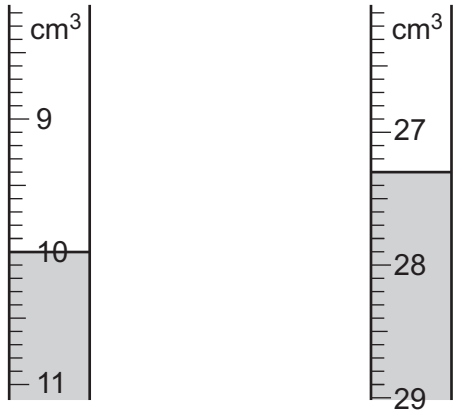
.....

..... [1]

(ii) Name a piece of apparatus suitable for measuring the 25.0 cm^3 of aqueous sodium hydroxide in step 3.

..... [1]

(iii) Fig. 2.1 shows the initial reading of dilute sulfuric acid in the burette and the reading when the litmus changes to red.



initial reading

reading when the litmus changes to red

Fig. 2.1

Record in Table 2.1 the burette readings to the nearest 0.1 cm^3.

Table 2.1

initial reading / cm^3	
reading when the litmus changes to red / cm^3	

[2]

(iv) Calculate the volume of dilute sulfuric acid added to change the colour of the litmus.

Use the equation shown.

volume of dilute sulfuric acid added = reading when the litmus changes to red – initial reading

volume of dilute sulfuric acid added = ... cm^3 [1]

(v) Explain why in step 5 the student adds the dilute sulfuric acid slowly instead of adding it all in one go.

.....

..... [1]

(b) Procedure

The student:

step 9 adds a black insoluble powder called carbon to the red solution in the flask

step 10 warms this mixture and then allows it to cool

step 11 filters the mixture into a clean flask to obtain a colourless solution of the salt.

(i) Describe the appearance of the **residue** in the filter paper after step 11.

..... [1]

(ii) The filtrate is a colourless solution of the salt.

Suggest the function of the carbon in steps 9 and 10.

.....

..... [1]

(c) The student wants to obtain crystals of the salt from the colourless solution.

Describe what the student does to obtain crystals.

.....

.....

.....

.....

.....

..... [3]

(d) The student tests samples of the salt.

(i) The student does a flame test on a solution of the salt.

The student observes a yellow-coloured flame.

Identify the metal ion present in the salt.

..... [1]

(ii) The student adds dilute nitric acid followed by aqueous barium nitrate to a solution of the salt.

The student observes a white precipitate and no gas is formed.

Tick (✓) the correct box to identify the anion (negative ion) present in the salt.

carbonate	☐
chloride	☐
nitrate	☐
sulfate	☐

[1]

[Total: 13]

3 A student uses a balancing method to determine the mass of a metre rule.

The apparatus is shown in Fig. 3.1.

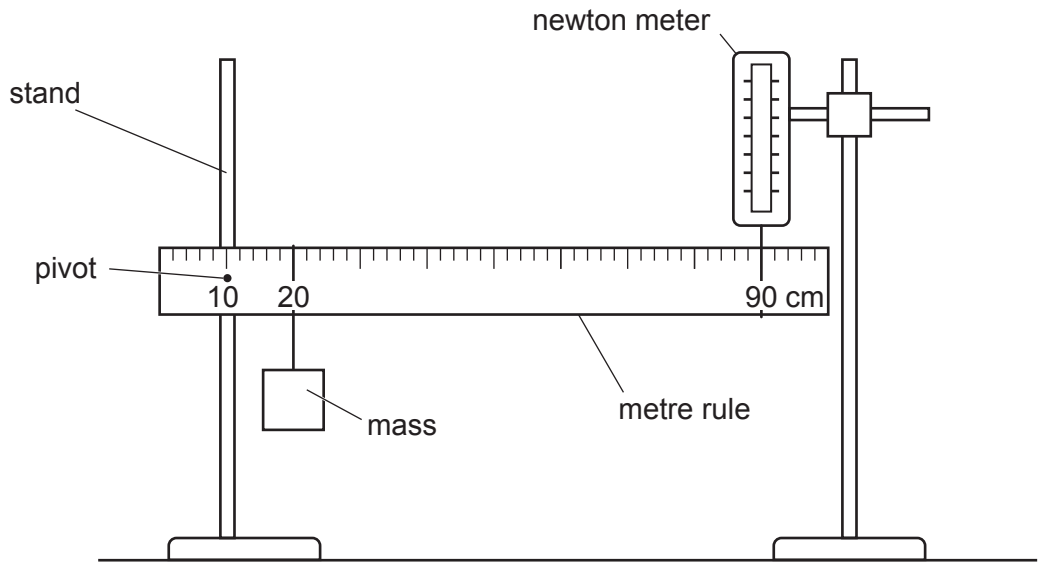


Fig. 3.1

The metre rule is attached to the stand at the 10 cm mark to form a pivot.

The metre rule can rotate freely about this pivot.

(a) Procedure

The student:

- suspends a mass from the metre rule at the 20 cm mark
- suspends the metre rule from a newton meter at the 90 cm mark
- adjusts the height of the newton meter so the metre rule is horizontal.

(i) Calculate the distance of the newton meter from the pivot.

distance of newton meter to pivot = ... cm [1]

(ii) When the metre rule is horizontal, the newton meter provides a balancing force *F*.

Fig. 3.2 shows the reading on the newton meter.

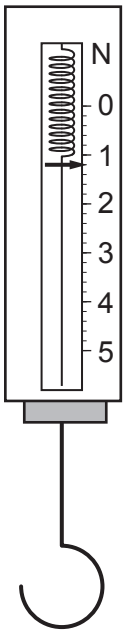


Fig. 3.2

Record the size of the balancing force *F* shown on the newton meter.

F = ... N [1]

(iii) State how the student avoids a line of sight (parallax) error when reading the newton meter scale.

.....

..... [1]

(iv) Suggest how the student makes sure the meter rule is horizontal.

.....

..... [1]

(b) Calculate the mass of the metre rule.

Use your value of *F* from **(a)(ii)** and the equation shown.

$$\text{mass of metre rule} = (200 \times F) - 123$$

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

mass of metre rule = ... g [2]

(c) The student measures the mass of the metre rule using an electronic balance.

mass of metre rule = 119 g

Explain whether the values of mass in **(b)** and **(c)** agree within the limits of experimental error.

.....

..... [1]

[Total: 7]

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4 Fig. 4.1 shows a 'drinks cooler sleeve'. The sleeve is a hollow cylinder which fits tightly around a glass containing water.

The sleeve is first chilled in a freezer at –20 °C.

The sleeve is then taken out of the freezer, and the glass containing water is placed inside it.

Fig. 4.1

The company that makes the sleeve claims that:

1 It can cool a glass containing 200 cm^3 of water at room temperature to below 10 °C in 5 minutes.
2 It can keep 200 cm^3 of water at a temperature below 10 °C for at least 30 minutes.

Plan an investigation to check whether the claims of the company are true.

You are provided with:

- the drinks cooler sleeve
- a glass that fits inside the sleeve
- access to a freezer
- access to water at room temperature.

You may use any common laboratory apparatus in your plan.

Include in your plan:

- the apparatus needed
- a brief description of the method
- what you will measure
- how you will use your results to draw a conclusion.

You may include a labelled diagram.

You may include a results table (you are not required to enter any readings in the table).

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..... [7]

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