Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9116474472

CO-ORDINATED SCIENCES **0654/62**

Paper 6 Alternative to Practical **October/November 2017**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **18** printed pages and **2** blank pages.

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1 Fig. 1.1 shows a bean seedling from a seed that has germinated and has started to grow.

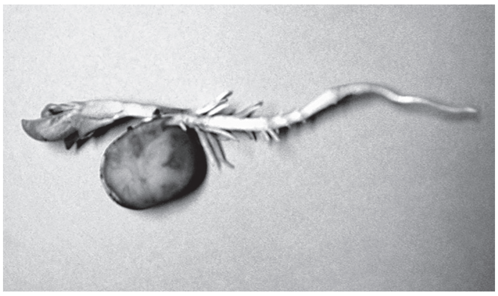


Fig. 1.1

(a) In the box provided, make an enlarged pencil drawing of the seedling.

Label the root and stem.

[3]

(b) **(i)** Measure the length of the bean **seed** in Fig. 1.1, excluding the root and stem.

Record this length, in millimetres, to the nearest millimetre.

length of seed in Fig. 1.1 .... mm [1]

(ii) Use a straight line to show this length on your drawing.

Record the length of this line, in millimetres, to the nearest millimetre.

length of seed in drawing .... mm [1]

(iii) Use your measurements in **(i)** and **(ii)** to calculate the magnification of your drawing.

magnification = ...[1]

(c) **(i)** A student wants to carry out an experiment on some germinated bean seeds.

Describe how the student can germinate the seeds.

....

....

....[2]

(ii) The student tests the bean seeds for their nutrient content.

Her results are shown in Table 1.1.

Table 1.1

	Benedict's test	biuret test	iodine test
colour observed	clear blue	purple	blue-black

Use the information in Table 1.1 to identify the nutrients present in the bean seeds.

....[2]

2 A student investigates the reactions of **H**, a solution of a sodium compound.
He assesses whether **H** could be used as a reagent to identify cations in qualitative analysis.
A good reagent in qualitative analysis gives positive and different results with different ions.

He adds **H** to each of the following solutions.

ammonium sulfate
copper sulfate
iron(III) sulfate
zinc sulfate

He records his observations in Table 2.1.

Table 2.1

solution	observation
ammonium sulfate	no visible reaction
copper sulfate	blue precipitate
iron(III) sulfate	brown precipitate
zinc sulfate	white precipitate

(a) **(i)** Use the observations in Table 2.1 to explain whether **H** could be used as a reagent to identify cations.

You should make comparisons with the usual reagents used for the analysis of cations.

....

....

....

....[2]

(ii) Suggest a solution, **not** shown in Table 2.1, which you could expect to give a different coloured precipitate with **H**.

....

....[1]

(iii) Describe another test, not involving **H**, and its observations that the student could carry out to identify the ammonium ion in ammonium sulfate solution.

test ....

....

observations ....

....
[2]

(b) The student tests for sulfate ions in **H** but only adds barium nitrate solution. A white precipitate is produced.

He incorrectly concludes that **H** is sodium sulfate solution.

H is sodium carbonate solution.

(i) State the full details of the test for a sulfate that the student should have carried out.

State what he observes if he carries out this full test on **H** (sodium carbonate).

details of test ....

....

observations ....

....

.... [2]

(ii) Draw a labelled diagram to describe a test to identify the carbonate ion in **H**.

[2]

(iii) State the observation in **(b)(ii)** that would confirm the presence of the carbonate ion in **H**.

....

....[1]

3 A student investigates the cooling rates of different volumes of water.

The apparatus used is shown in Fig. 3.1.

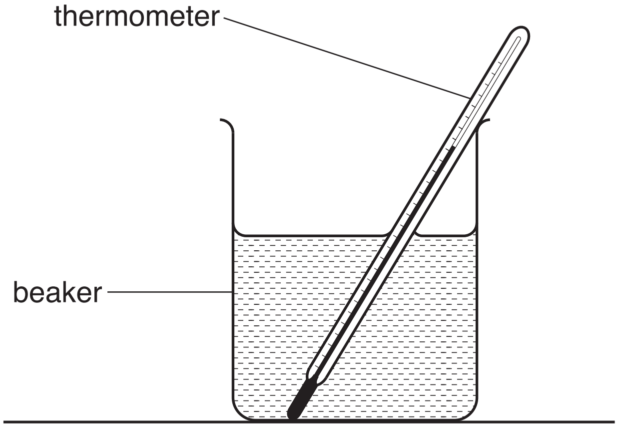


Fig. 3.1

The student labels a beaker **P** and pours 200 cm^3 of hot water into the beaker.

After waiting for a short while, he reads and records the temperature θ.

Table 3.1

	cooling of 200 cm^3 of hot water in beaker **P**	cooling of 100 cm^3 of hot water in beaker **Q**
time t/	temperature θ/	temperature θ/ ....
0		
	87.0	89.0
	85.0	86.0
	83.5	83.5
	82.0	81.0
	81.0	78.5
	80.0	76.0

(a) **(i)** Read and record in Table 3.1 the temperature of the water in beaker **P** shown in Fig. 3.2 at time $t = 0$.

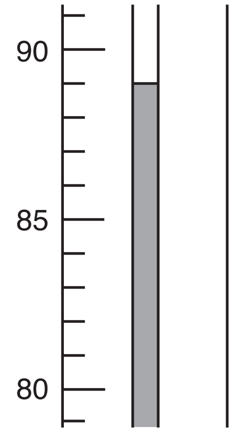


Fig. 3.2

[1]

(ii) The student pours $100\,cm^3$ of hot water into another beaker and labels it **Q**. The temperature rises to the value shown in Fig. 3.3.

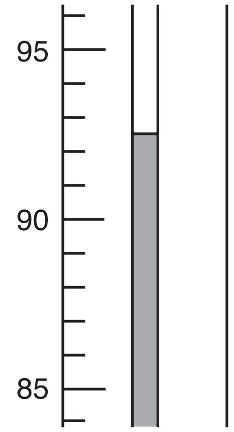


Fig. 3.3

Read and record in Table 3.1 the temperature of the water in beaker **Q** shown in Fig. 3.3 at time $t = 0$. [1]

(b) The student measures the temperature of the water in each beaker at 30 second intervals for 3 minutes. These temperatures are shown in Table 3.1.

(i) Complete the column headings in Table 3.1 by inserting the correct units. [1]

(ii) Insert the values of t in Table 3.1. [1]

(c) Suggest why it is important for the student to wait a short while before measuring the initial temperature of the hot water in both beakers.

....

....[1]

(d) The temperature of the water in both beakers decreases with time.

Give **one other** similarity in the way that the temperature of the water in both beakers decreases with time.

....

....[1]

(e) Another student suggests that the rate of cooling is slower for the larger volume of water than for the smaller volume of water.

Use the results in Table 3.1 to show that the results support this suggestion.

....

....

....[2]

(f) The experiment is repeated with the same apparatus to check the results.

Suggest **two** variables that should be kept constant.

variable 1 ....

variable 2 ....
[2]

Please turn over for Question 4.

4 A student investigates the effect of temperature on the movement of water through a plant.

He sets up the apparatus shown in Fig. 4.1.

- The student records the initial position of the air bubble.
- He leaves the apparatus at a low temperature for 10 minutes and records the new position of the air bubble.
- He repeats this at a high temperature.

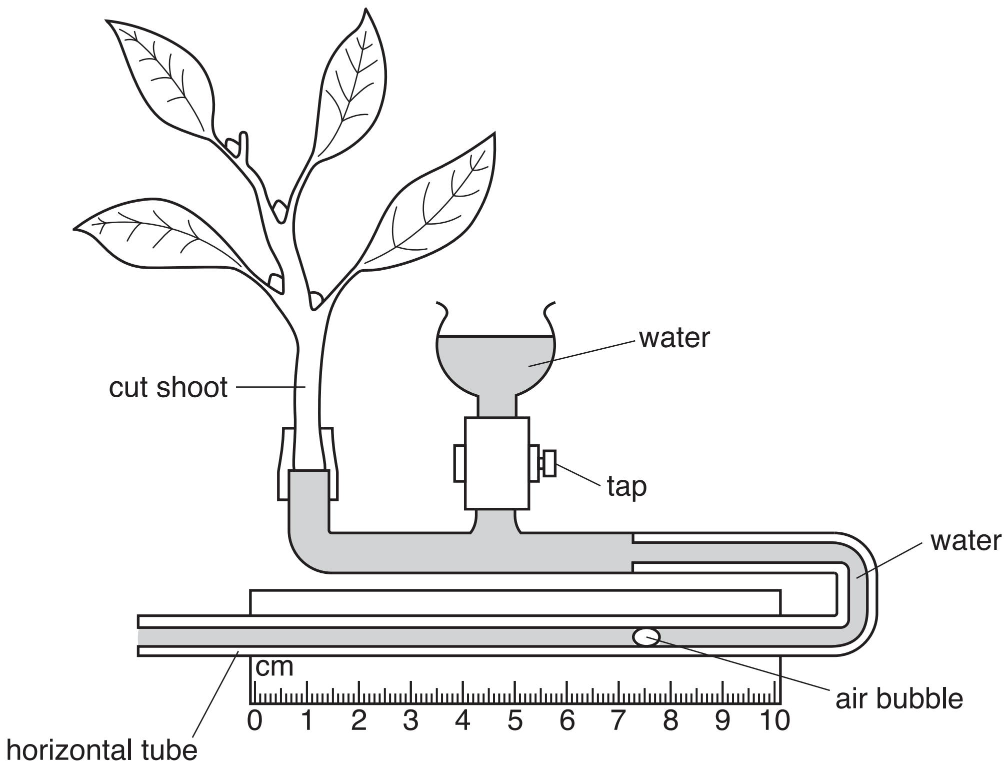


Fig. 4.1

(a) The movement of the air bubble in the apparatus shows the uptake of water by the shoot.

Table 4.1 shows some of the results the student obtains.

Table 4.1

temperature	initial position of bubble / cm	position of bubble after 10 minutes / cm	distance moved in 10 minutes / cm	average distance moved in 10 minutes / cm	average distance moved per minute / cm
low temperature trial 1	2.1	3.6	1.5	1.6	
low temperature trial 2	3.7	5.4	1.7		
high temperature trial 1					
high temperature trial 2	3.8	6.8			

(i) Fig. 4.2 shows the initial position of the air bubble for trial 1 at high temperature and its position after 10 minutes.

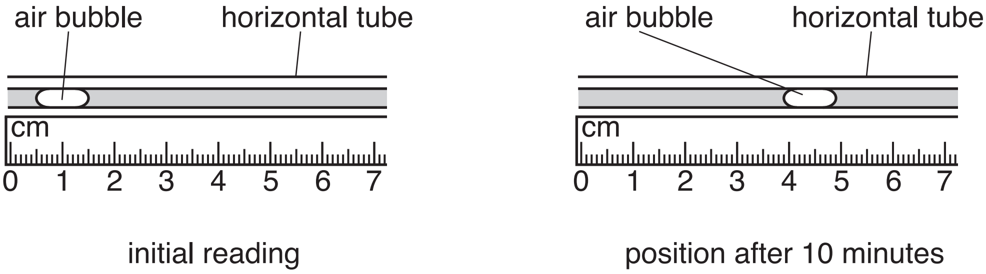


Fig. 4.2

Measure the positions of the bubble at the right hand side of the bubble.

Record these positions in Table 4.1. [1]

(ii) Calculate the distances and the average distance moved in 10 minutes by the air bubbles for the high temperature trials.

Record these in Table 4.1. [2]

(iii) Calculate and record, in the last column of Table 4.1, the average distances moved per minute at each temperature.

[1]

(iv) Use the information in Table 4.1 to state the effect of temperature on the rate of water uptake by the plant.

....[1]

(b) The teacher suggests that the student should carry out a third trial at each temperature.

Explain why this improves the investigation.

....

....

....[2]

(c) (i) Name the process by which water is lost by evaporation from the leaves of the shoot.

....[1]

(ii) Suggest why the amount of water taken up by the shoot may **not** be the same as the water lost by the shoot.

....

....[1]

(d) Predict **and** explain the effect on the rate of bubble movement if the experiment is repeated with two of the leaves removed from the cut shoot in Fig. 4.1.

....

....[1]

Please turn over for Question 5.

5 Copper sulfate is a salt.

A student uses the following method to make a pure sample of copper sulfate crystals.

step 1
Place some acid in a beaker.

step 2
Add copper carbonate solid to the acid while stirring, until the copper carbonate no longer reacts.

step 3
Filter the mixture to remove excess copper carbonate.

step 4
Heat the blue filtrate until its volume is halved.

step 5
Pour this remaining liquid into an evaporating dish.

step 6
Allow the water in the remaining liquid in the dish to evaporate at room temperature.

(a) **(i)** Name the acid used in **step 1**.

....[1]

(ii) Suggest how the student knows when there is no further reaction in **step 2**.

....

....[1]

(iii) Suggest how the student can test the mixture to make sure that all of the acid has reacted.

test ....

observation ....
[2]

(b) **(i)** Draw a diagram of the apparatus used in **step 3**.

Label the excess copper carbonate and the filtrate.

[2]

(ii) State which property of copper carbonate allows the excess copper carbonate to be removed from the mixture.

....

....[1]

(c) Explain why it is important in **step 4 not** to heat the filtrate to dryness.

....

....[1]

(d) Another student says that the same method may be used to make a sample of sodium chloride from hydrochloric acid and sodium hydroxide.

When she carries out the reaction she cannot separate the excess sodium hydroxide by filtration.

(i) Using your knowledge of sodium hydroxide in Qualitative Analysis, state why filtration cannot be used to separate excess sodium hydroxide from the sodium chloride solution.

....

....[1]

(ii) Describe briefly an alternative method to make a sample of sodium chloride from hydrochloric acid and sodium hydroxide.

....

....[1]

6 A student measures the mass of a metre rule using a balancing method.

- She places a pivot directly under the 60.0 cm mark of a metre rule so that the distance *d*, measured from the end of the metre rule to the pivot, is 60.0 cm.
- She places a load of 200 g on the metre rule.
- She adjusts the position of the load carefully, until the rule is just balanced.

Fig. 6.1 shows the rule when balanced.

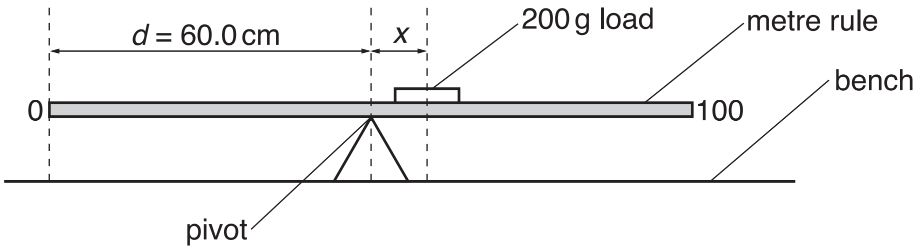


Fig. 6.1

- She determines the scale reading at the centre of the 200 g load.

Fig. 6.2 shows part of the scale of the rule when balanced.

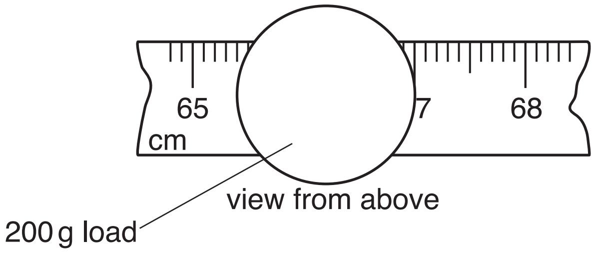


Fig. 6.2

(a) Use the information in Fig. 6.2 to determine the position *p* of the centre of the load when balanced.

Show your working and record *p* in Table 6.1.

[2]

Table 6.1

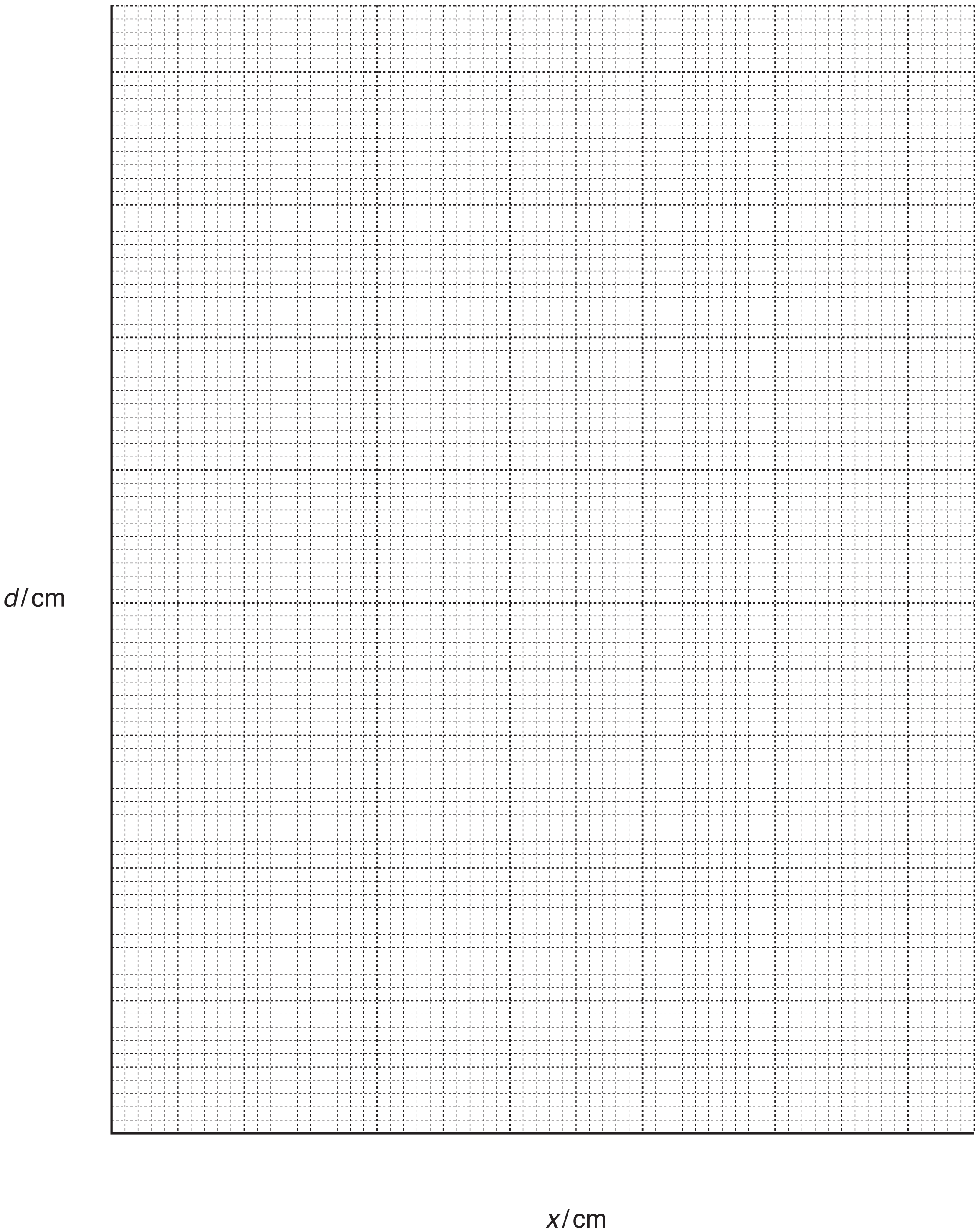
distance *d* of pivot / cm	position *p* of centre of load when balanced / cm	distance of load from pivot $x = (p-d)$ / cm
60.0		
65.0	74.0	
70.0	81.8	11.8
75.0	90.0	15.0
80.0	97.9	17.9

(b) The student repeats this procedure to balance the load when the pivot is placed at distances d = 65.0 cm, 70.0 cm, 75.0 cm and 80.0 cm from the end of the metre rule. She records the positions p for each value of d in Table 6.1.

Calculate the distance x of the load from the pivot, using $x = (p - d)$, for values of d = 60.0 cm and 65.0 cm.

Record these values in Table 6.1. [1]

(c) **(i)** On the grid provided, plot a graph of d (vertical axis) against x. You do **not** need to start the axes from the origin (0, 0). Draw the best-fit straight line.



[3]

(ii) Calculate the gradient of your line.

Show all working and indicate on your graph the values you chose to enable the gradient to be calculated.

gradient = ... [2]

(iii) The gradient of your line is related to the mass *m* in grams of the metre rule, by the equation shown.

$$m = \frac{200}{\text{gradient}}$$

Calculate the mass *m* of the metre rule.

m = ... g [1]

(d) When carrying out the experiment, the student decided **not** to place the pivot at distances greater than 80.0 cm from the end of the rule.

Suggest why this was a sensible decision.

....

....[1]

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