Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1008579266

CO-ORDINATED SCIENCES **0654/62**

Paper 6 Alternative to Practical **May/June 2018**

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.

DC (LEG/CGW) 149907/6

1 A student investigates bananas.

He peels a banana and cuts a slice from one end. He places the slice on a white tile with the cut surface uppermost as shown in Fig. 1.1.

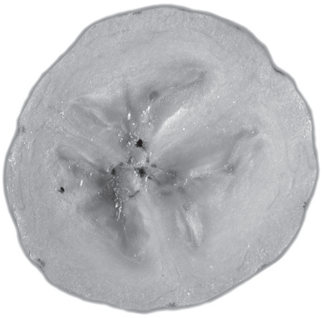


Fig. 1.1

(a) **(i)** In the box shown, make a detailed and enlarged pencil drawing of the cut face of the banana slice shown in Fig. 1.1.

[2]

(ii) Draw a horizontal line on the banana slice shown in Fig. 1.1 to represent the diameter.

Measure the diameter of the banana slice shown in Fig. 1.1, in millimetres, to the nearest millimetre.

diameter = ... mm

Draw a horizontal line on your drawing of the banana slice to represent the diameter.

Measure the diameter of your drawing of the banana slice, in millimetres, to the nearest millimetre.

diameter = ... mm
[2]

(iii) Use these **two** measurements to calculate the magnification of your drawing.

Show your working.

magnification = ...[1]

(b) The student adds some biuret solution to some mashed banana.

He observes a blue colour.

Explain his observation.

....

....[1]

(c) (i) Describe how you could test the banana for the presence of nutrients using Benedict's solution. Name the nutrient being tested for and the expected observation for a positive result.

method ....

....

nutrient tested for ....

observation for a positive result ....
[3]

(ii) State **and** explain **one** safety precaution that is taken in this test.

....

....[1]

2 A student investigates the reactions of metal oxide **H**, a red solid.

(a) She places some of **H** in a hard glass test-tube and heats it strongly.

A black solid forms. She leaves this black solid to cool.

(i) She adds an acid to the black solid and warms carefully.

After heating, she allows the mixture to settle and observes a blue solution.
She suspects that the solution contains the Cu^{2+} ion.

Describe a test that the student could carry out on the solution to identify the cation present.

Include in your answer the observations that will identify the cation as Cu^{2+}.

test ....

....

observations ....

....
[2]

(ii) The acid the student used in **(a)(i)** is either hydrochloric acid or sulfuric acid.

Complete Table 2.1 to describe two tests which she uses to identify the acid.

Include in Table 2.1 the observations which would be expected for both tests on each acid.

Table 2.1

test	observation with hydrochloric acid	observation with sulfuric acid

[3]

(b) Next the student takes another sample of red solid **H** and adds acid to it.
She heats the mixture and allows it to cool.
She then filters the mixture.
The residue is red-brown and the filtrate is blue.

Draw a labelled diagram of the apparatus that the student uses for the filtering of the mixture.

Identify the positions of the filtrate and the residue on your diagram.

[2]

(c) The student places the blue filtrate from **(b)** into a beaker. She adds one spatula load of magnesium powder and stirs.

The beaker becomes quite hot.

When the mixture settles the solution is now colourless and the powder is pink.

(i) Name the type of reaction that takes place between magnesium and the filtrate from **(b)**.

....[1]

(ii) Identify the pink powder.

....[1]

(d) Suggest why the test-tube used in **(a)** is a hard glass test-tube.

....

....[1]

3 A student measures the approximate mass of a metre rule using a balancing method.
She sets up the apparatus as shown in Fig. 3.1.

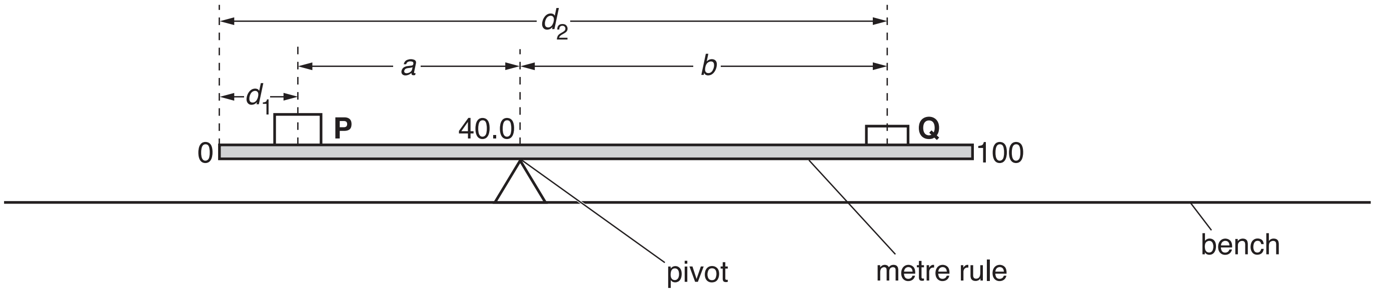


Fig. 3.1

(a) Procedure

- The pivot is under the 40.0 cm mark. **The position of the pivot does not change during this experiment**.
- She places a load **P** of mass 200 g on the rule so that its centre is at a distance d_1 = 10.0 cm from the zero end of the rule, as shown in Fig. 3.1.
- She adjusts the position of the load **Q**, of mass 100 g, so that the rule is as close as possible to being balanced.

Part of the balanced rule is shown in Fig. 3.2.

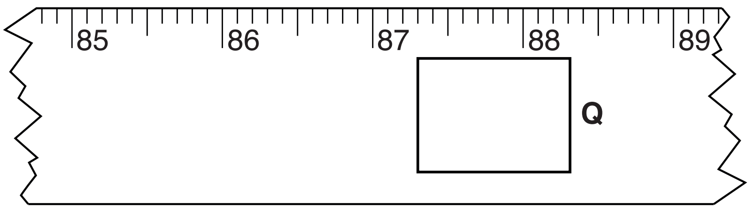


Fig. 3.2

(i) Record, to the nearest 0.1 cm, in Table 3.1, the position of the centre of load **Q** shown in **Fig. 3.2**. This is the distance d_2 from the zero end of the rule to the **centre** of load **Q**. [1]

Table 3.1

d_1 / cm	d_2 / cm	$a = (40 - d_1)$ / cm	$b = (d_2 - 40)$ / cm
10.0			
15.0	78.0	25.0	38.0
20.0	68.1	20.0	28.1
25.0	57.2	15.0	17.2
30.0	47.9	10.0	7.9

(ii) Suggest **and** describe a method by which the student ensures that the centre of load **P** is directly above the 10.0 cm mark on the rule.

....

....[1]

(b) The student repeats the procedure in **(a)** for values of d_1 = 15.0 cm, 20.0 cm, 25.0 cm and 30.0 cm. Her results are shown in Table 3.1.

For d_1 = 10.0 cm, calculate the distances *a* and *b*. Use the equations shown.

$$a = (40 - d_1)$$

$$b = (d_2 - 40)$$

Record, in Table 3.1, your values of *a* and *b*. [1]

(c) **(i)** On the grid provided, plot a graph of *a* (vertical axis) against *b*. Start your axes from the origin (0, 0).

[3]

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

(iii) Write down the value of the intercept I on the vertical axis.

I = ...[1]

(d) The mass *m* in grams of the metre rule is given by the equation shown.

$$m = 20 \times I$$

Use this equation to calculate a value for *m*. Give your answer to an appropriate number of significant figures.

m = ... g [1]

(e) Suggest **one practical** reason why, despite carrying out the experiment with care, the student's value for the mass of the rule is only approximate.

....

....[1]

Please turn over for Question 4.

4 A student investigates if light and chlorophyll are needed for photosynthesis.

She has two plants. Before she can start her investigation she needs to de-starch (remove the starch from) both plants.

(a) Describe how she de-starches the plants.

....

....

....[2]

(b) She places one of these plants in the dark and the other plant in the light for a few days. A leaf from each plant is tested for the presence of starch using iodine solution.

Describe how she carries out this test. Include in your answer:

- method
- safety precautions
- observation for a positive result.

....

....

....

....

....

....[4]

(c) Explain why the student needs to de-starch the plants.

....

....[1]

(d) The plant in the light tests positive for starch. The plant in the dark does not.

The green pigment chlorophyll is also needed for photosynthesis.

Fig. 4.1 shows two leaves from another de-starched plant. Leaf **A** is kept in the light and leaf **B** is kept in the dark.

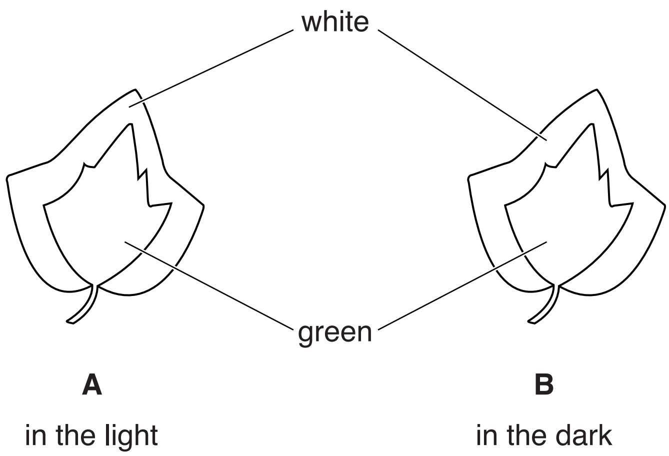


Fig. 4.1

The student tests these leaves for the presence of starch.

On Fig. 4.2, complete the label lines to show her observations after she tests the leaves with iodine solution.

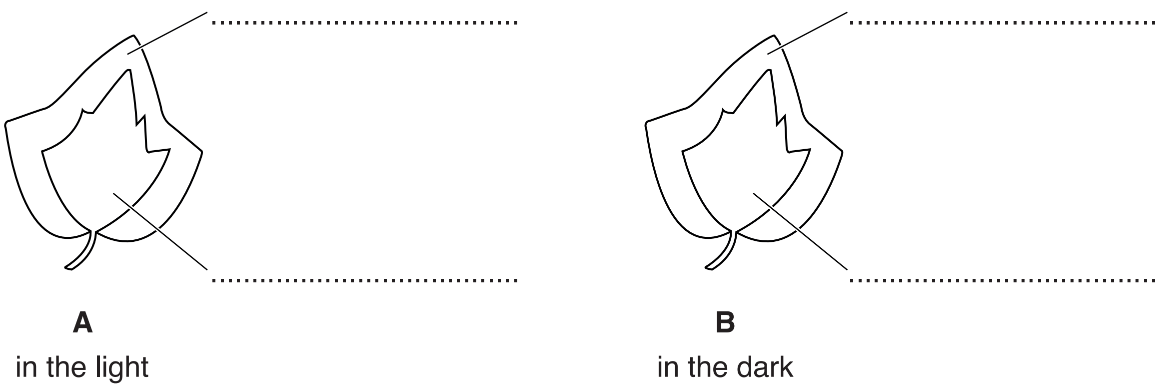


Fig. 4.2

[3]

BLANK PAGE

5 A student investigates the rate of reaction of calcium carbonate with hydrochloric acid.

Calcium carbonate reacts with hydrochloric acid to form calcium chloride, water and carbon dioxide gas. As the carbon dioxide gas is given off during the reaction the mass of the reactants decreases.

(a) Procedure

- She places 5g of finely powdered calcium carbonate (which is an excess) into a conical flask.
- She adds 50 cm^3 of dilute hydrochloric acid into the conical flask.
- The acid is at a temperature of 25 °C.
- She quickly places cotton wool into the neck of the flask and puts the flask onto the balance, as shown in Fig. 5.1.

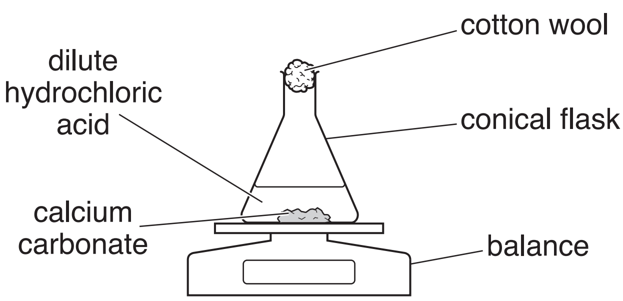
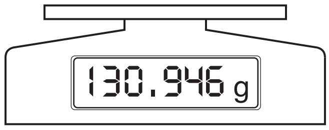


Fig. 5.1

- She immediately measures the mass of the flask and contents and records it in Table 5.1 at time *t* = 0 minutes.
- She measures and records, in Table 5.1, the mass of the flask and contents every minute until there is no further change in mass.

Fig. 5.2 shows the reading for the mass of the flask and contents at t = 5 minutes. **Record this mass in Table 5.1.**



mass at 5 minutes

Fig. 5.2

Table 5.1

t / minutes	mass of flask and contents / g
0	132.62
1	131.74
2	131.40
3	131.21
4	131.06
5	
6	130.88
7	130.82
8	130.81
9	130.80
10	130.80

[1]

(b) **(i)** Use the values in Table 5.1 to calculate the total mass of carbon dioxide gas given off.

mass = ... g [1]

(ii) The total amount of carbon dioxide gas expected is 1.90 g.

Suggest **one** reason why your value in **(b)(i)** is different from this.

....

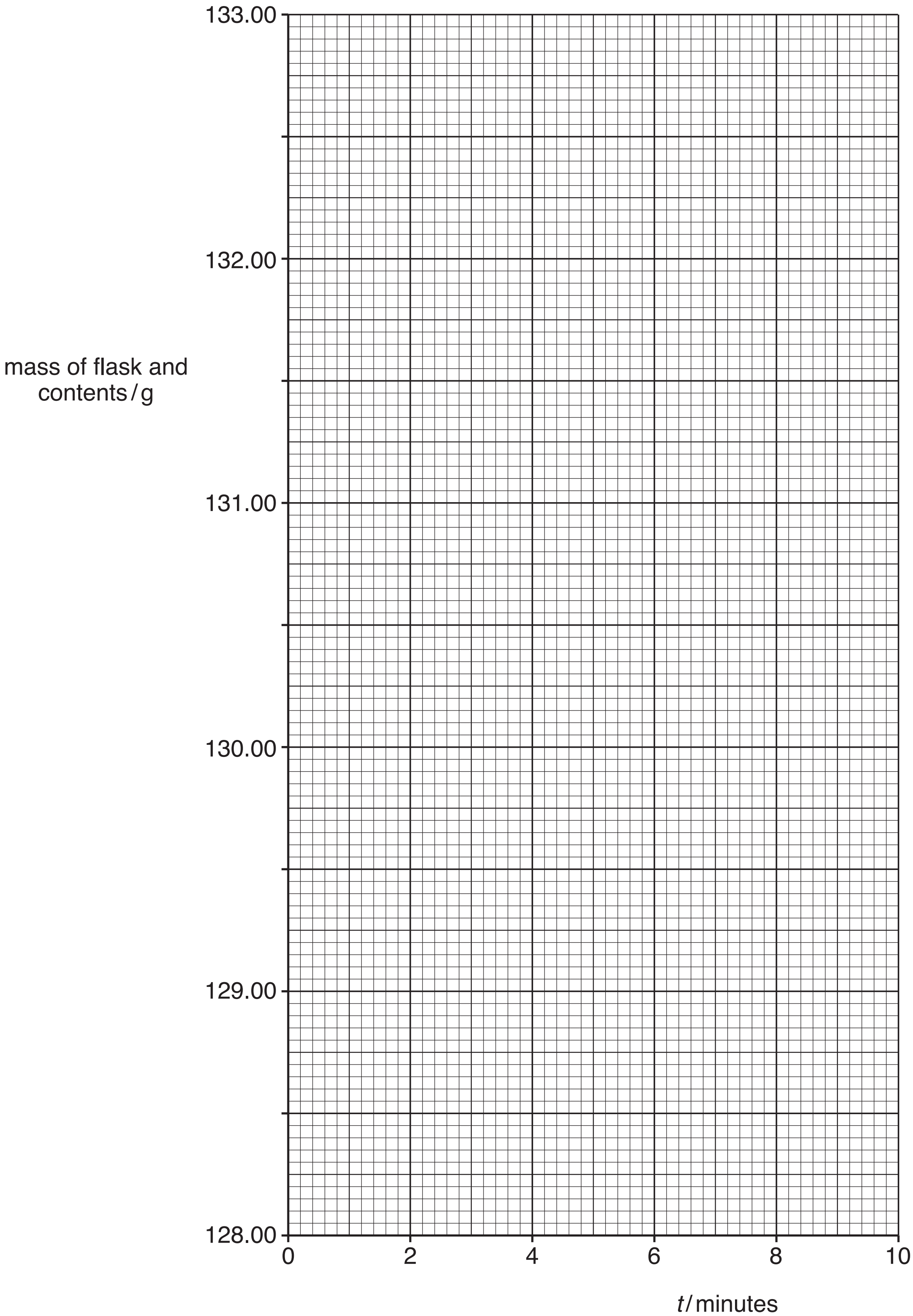
....[1]

(c) Explain why cotton wool was placed into the neck of the flask.

....

....[1]

(d) (i) On the grid provided, plot a graph of mass of flask and contents against time.



[1]

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

(e) **(i)** The student repeats the procedure in **(a)** using 100 cm^3 of the same dilute hydrochloric acid at the same temperature. The 5 g of powdered calcium carbonate is still an excess.

Sketch on the grid in **(d)(i)** the line she should expect to get from her experiment. Assume that the starting mass of the flask and contents at time t = 0 is 132.62 g. Label this line **F**.
[2]

(ii) The student repeats the procedure in **(a)** using 50 cm^3 of the same dilute hydrochloric acid but which is at a temperature of 40 °C.

Sketch on the grid in **(d)(i)** the line she should expect to get from her experiment. Start the line in the same place as the line drawn in **(d)(ii)**. Label this line **M**. [2]

Please turn over for Question 6.

6 A student investigates the speed gained by a ball as it rolls down a ramp.

He sets up the apparatus shown in Fig. 6.1.

He marks **P** and **Q** on the surface of the bench so that they are 1 m apart.

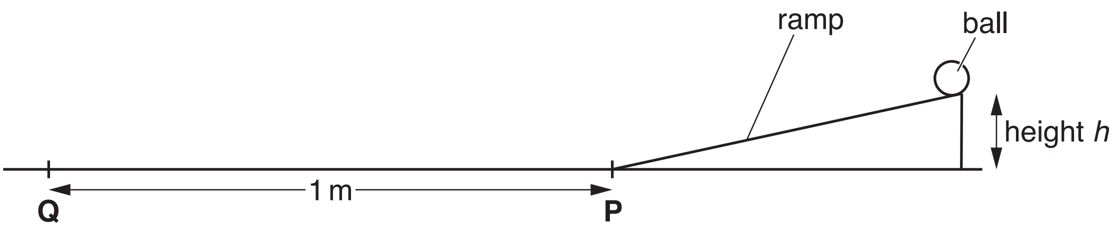


Fig. 6.1

The shorter the time it takes for the ball to roll between **P** and **Q**, the higher the average speed of the ball.

Procedure

- He adjusts the height *h* of the ramp to 5 cm.
- He releases the ball from rest at the top of the ramp.
- When the ball reaches **P** he starts the timer and he stops the timer when the ball reaches **Q**.
- He records the time *t* in Table 6.1.
- He repeats this procedure twice more and calculates the average time for the ball to roll between **P** and **Q**.
- He then repeats the experiment with the ramp at heights *h* = 10 cm, 15 cm, 20 cm and 25 cm.

Table 6.1

height *h* of ramp / cm	time *t* for ball to roll between **P** and **Q** / s			
	t_1	t_2	t_3	average time
5	4.5	5.1	4.8	4.8
10			3.6	
15	2.5	3.1	2.7	2.8
20	2.5	1.9	2.4	2.3
25	1.7	2.1	5.4	

(a) **(i)** The timer displays for t_1 and t_2 at 10 cm are shown in Fig. 6.2.

Record, in Table 6.1, the times t_1 and t_2 to the nearest 0.1 seconds.

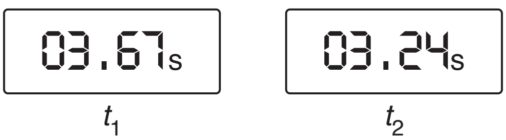


Fig. 6.2

[2]

(ii) Calculate the average time for h = 10 cm.

Record this average time in Table 6.1. [1]

(iii) Suggest why all of the times recorded are likely to be inaccurate.

....

....[1]

(iv) Explain why the experiment was performed three times at each height.

....

....[1]

(v) State the relationship between height h of the ramp and the average speed of the ball between **P** and **Q**.

....

....[1]

(b) (i) The value of t_3 at h = 25 cm is incorrect. It is possible that the student has misread the timer. Suggest another reason for this incorrect timing.

....

....[1]

(ii) Calculate the average time for h = 25 cm.

Record this average time in Table 6.1. [1]

(c) The student decides to use the same apparatus to investigate the relationship between the mass of the ball and its average speed between **P** and **Q**.

State **two** variables which must be kept constant during this experiment.

1 ....

2 ....
[2]

BLANK PAGE