Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

COMBINED SCIENCE **0653/62**

Paper 6 Alternative to Practical **October/November 2019**

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.

1 A student investigates the concentration of vitamin C in two samples of fruit juice, **A** and **B**.

Iodine solution and starch can be used to estimate the concentration of vitamin C in a sample of fruit juice. Iodine solution is added to a starch fruit juice mixture until the solution remains blue-black.

The more iodine solution that needs to be added to produce a permanent blue-black colour, the higher the concentration of vitamin C in the sample.

(a)
- The student puts 20 cm^3 of fruit juice **A** into a beaker.
- He adds 1 cm^3 starch solution to the fruit juice using a measuring cylinder and stirs.
- He puts 10 cm^3 iodine solution into a second beaker.
- He uses a pipette to add a few drops of the iodine solution to the fruit juice and starch mixture and stirs.
- He continues adding iodine solution until the colour changes to blue-black.
- He pours the remaining unused iodine solution into a measuring cylinder.
- He records in Table 1.1 the volume of unused iodine solution **remaining** for experiment **1**.

Table 1.1

fruit juice **A** experiment	volume of unused iodine solution remaining / cm^3	volume of iodine solution added / cm^3	average volume, V_A, of iodine solution added / cm^3
1	8.0	2.0	
2	7.5	2.5	
3			

He repeats the experiment twice more. He records in Table 1.1 the volume of unused iodine solution **remaining** for experiment **2** and experiment **3**.

The reading on the measuring cylinder for the volume of remaining iodine solution for experiment **3** is shown in Fig. 1.1.

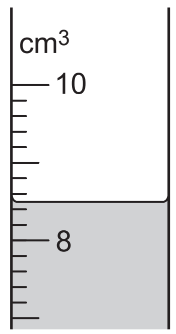

Fig. 1.1

(i) Read and record in Table 1.1 the volume shown in Fig. 1.1 to the nearest 0.5 cm^3. [1]

(ii) Calculate the volume of iodine solution that has been **added** to the fruit juice in experiment **3**. Record this value in Table 1.1.

[1]

(iii) Calculate the average volume, V_A, of iodine solution added to fruit juice **A**. Record this value in Table 1.1.

[1]

(b) The student repeats **(a)** with fruit juice **B**. He records the volumes in Table 1.2.

Table 1.2

fruit juice **B** experiment	volume of unused iodine solution remaining / cm^3	volume of iodine solution added / cm^3	average volume, V_B, of iodine solution added / cm^3
1	9.5	0.5	
2	5.5	4.5	
3	9.5	0.5	

Calculate the average volume, V_B, of iodine solution added to fruit juice **B**. Record this value in Table 1.2.

[2]

(c) State what can be concluded about the concentration of vitamin C in fruit juice **A** compared to fruit juice **B**. Use the results in Table 1.1 and Table 1.2.

....

.... [1]

(d) **(i)** Calculate the concentration of vitamin C in fruit juice **A** using the equation shown.

$$\text{concentration} = \frac{V_A \times 0.025}{20}$$

Give your answer to an appropriate number of significant figures.

concentration = ... g/cm^3 [2]

(ii) Suggest **one** piece of apparatus that can be used to measure the 1 cm^3 of starch solution more accurately.

.... [1]

(e) Fig. 1.2 shows half of a fruit that contains vitamin C.

Fig. 1.2

In the box below, make an enlarged detailed drawing of the cut surface of the fruit.

[3]

(f) State the name of a reagent that could be used to test the fruit for the presence of protein.

.... [1]

[Total: 13]

2 A student has a sample of a green powder, **E**.

(a)
- She places a small amount of powder **E** into a test-tube and heats it gently.
- She bubbles the gas formed into limewater in a test-tube. The limewater turns milky.
- The green powder changes into a black powder **F**.

(i) Draw a labelled diagram of the assembled apparatus and chemicals she uses in **(a)**.

[2]

(ii) State the identity of the gas formed.

.... [1]

(iii) State the identity of the anion in powder **E**.

.... [1]

(b)
- The student places the black powder **F** into a beaker of dilute sulfuric acid and heats it.
- She filters the mixture formed into two test-tubes.
- The liquid in the two test-tubes is solution **G** and is blue in colour.
- She adds aqueous sodium hydroxide to one test-tube of solution **G**.
- A pale blue precipitate forms.
- She performs a flame test on the sample of solution **G** in the other test-tube.
- The flame colour she observes is blue-green.

State the identity of the cation in solution **G**, powder **E** and powder **F**.

.... [1]

(c) State the identities of black powder **F** and blue solution **G**. Use the results in **(a)** and **(b)**.

identity of **F** ....

identity of **G** ....
[2]

[Total: 7]

3 Fizzy drinks are fizzy because they have carbon dioxide dissolved in them.

The carbon dioxide is dissolved under pressure. As soon as the top is taken off a bottle of fizzy drink, the carbon dioxide gas starts to bubble out of the drink.

If the top is left off the bottle, the carbon dioxide will start to leave the drink. The drink will eventually ‘go flat’ (not fizzy) when all of the carbon dioxide has left the drink. This will also happen if the drink is poured into a glass.

The drink will lose all of its carbon dioxide more quickly if it is heated.

Plan an experiment to compare the **amount** of dissolved carbon dioxide in the three fizzy drinks lemon soda, orange soda and sparkling water.

You may use any common laboratory apparatus and samples of lemon soda, orange soda and sparkling water.

Include in your answer:

- the apparatus needed, including a labelled diagram if you wish
- a brief description of the method, including any safety precautions and why these are needed
- the measurements you will make
- what you will control
- how you will process your results
- how you will use your results to draw a conclusion.

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.... [7]

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4 A student investigates how the period of a simple pendulum changes as its length changes.

Fig. 4.1 shows the apparatus used by the student.

The length of a pendulum is the distance from the point of support to the centre of the bob.

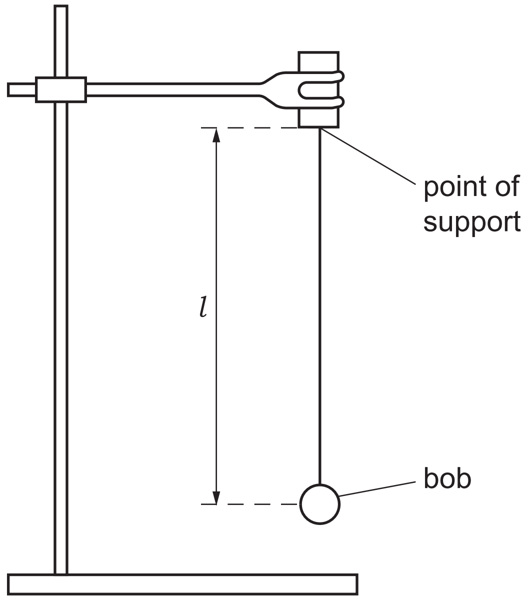


Fig. 4.1

(a) (i) Measure the length l on Fig. 4.1 to the nearest 0.1 cm.

length l of pendulum in Fig. 4.1 = ... cm [1]

(ii) Fig. 4.1 is drawn to a one-tenth scale.

Calculate the actual length L of the pendulum.
Record this length L in Table 4.1 on page 10.

[1]

(b) (i) The student measures the time for 10 complete oscillations of the pendulum. She repeats this measurement.

Fig. 4.2 shows the two stop-clock readings for her measurements.

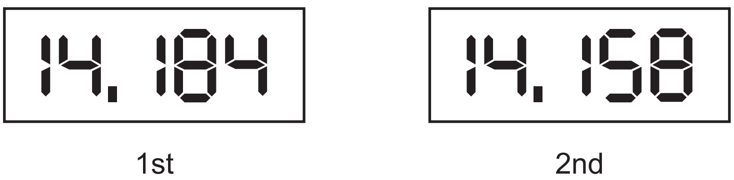


Fig. 4.2

Read and record in Table 4.1 the times for 10 oscillations of the pendulum to the nearest 0.01 s. [2]

Table 4.1

length L/cm	time for 10 oscillations /s		average time for 10 oscillations/s	period T/s	T^2/s^2
	1st	2nd			
40.0	12.63	12.69	12.66	1.266	1.60
35.0	11.98	11.95	11.97	1.197	1.43
25.0	10.10	10.19	10.15	1.015	1.03
20.0	9.22	9.32	9.27	0.927	0.86

(ii) Calculate the average time for 10 oscillations of the pendulum of length L. Record this time in Table 4.1.

[1]

(iii) Calculate the period T and T^2 for the pendulum of length L.

Record these values in Table 4.1. [1]

(c) The student repeats the experiment for pendulums with length L = 40.0, 35.0, 25.0 and 20.0 cm. Her results are recorded in Table 4.1.

(i) Describe one precaution that the student should take to ensure her timings of 10 complete oscillations are as accurate as possible.

....

....

.... [1]

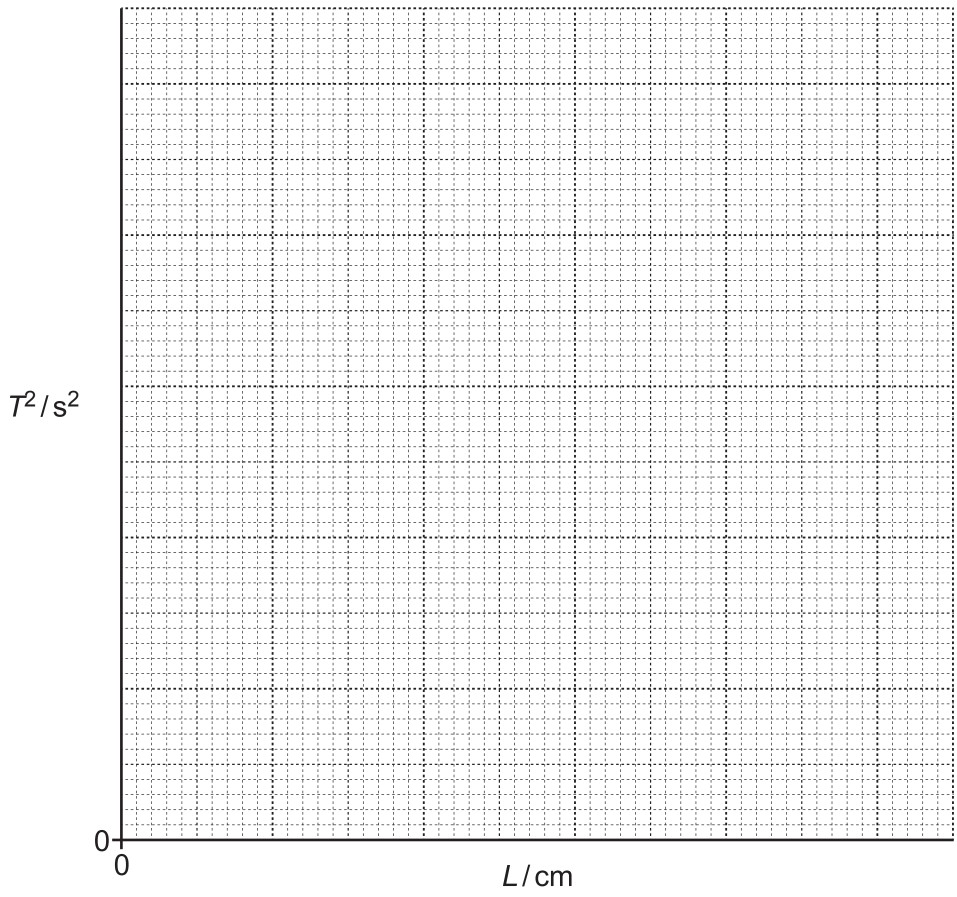
(ii) Explain why it is better to time 10 oscillations rather than one oscillation to determine the period T.

....

....

.... [2]

(d) **(i)** On the grid plot a graph of T^2 against L.



[2]

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

(e) Describe the relationship between the length L of the pendulum and T^2.

....

.... [1]

[Total: 13]

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