



**Cambridge Assessment International Education**  
Cambridge International General Certificate of Secondary Education

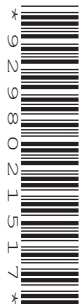
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**COMBINED SCIENCE**

**0653/62**

Paper 6 Alternative to Practical

**February/March 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.

This document consists of **15** printed pages and **1** blank page.

- 1 A student investigates the germination of seeds that have been kept at different temperatures. All other conditions were kept the same.

(a) Fig. 1.1 shows seeds in two dishes, dish **A** and dish **B**.

Dish **A** and dish **B** have been kept at two different temperatures.

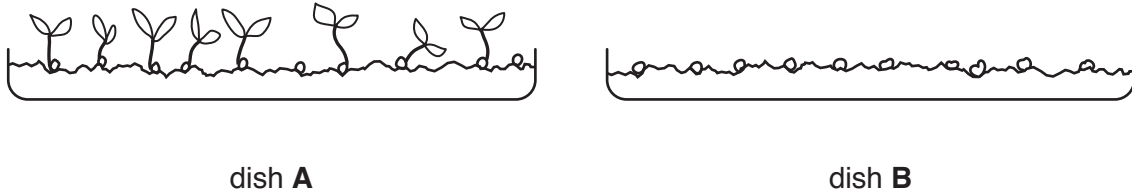


Fig. 1.1

The temperatures at which each dish was kept are shown in Fig. 1.2.

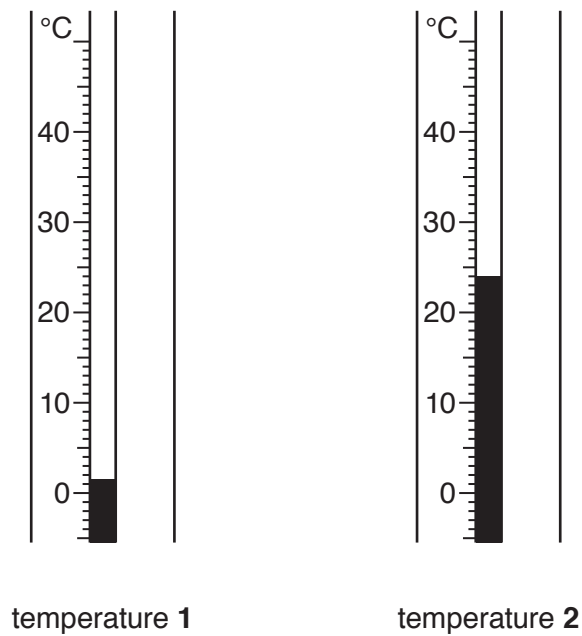


Fig. 1.2

- (i) Read the **two** temperatures shown in Fig. 1.2.

Record the values to the nearest 0.5 °C.

temperature **1** = ..... °C

temperature **2** = ..... °C

[2]

(ii) Look at the seeds in dish **A** and dish **B** in Fig. 1.1.

Suggest which dish was grown at temperature **1** and which dish was grown at temperature **2**. Give a reason for your answer.

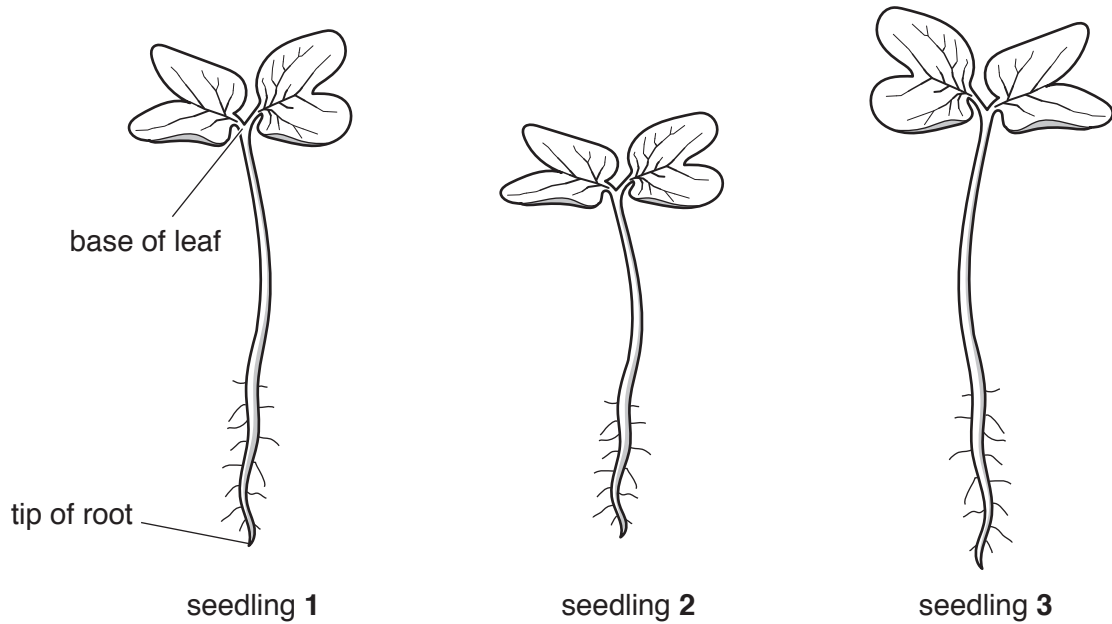
dish **A** temperature .....

dish **B** temperature .....

reason .....  
..... [1]

(b) Fig. 1.3 shows three of the germinated seeds from dish **A**.

(i) Use a ruler to measure, in millimetres, the length of the seedlings. Take your measurement from the base of the leaves to the tip of the root.



**Fig. 1.3**

length of seedling **1** = ..... mm

length of seedling **2** = ..... mm

length of seedling **3** = ..... mm

[1]

(ii) Calculate the average seedling length.

average seedling length ..... mm

[1]

- (c) Seeds from dish **B** were crushed. Some were tested with iodine solution and some were heated with Benedict's solution.

Complete Table 1.1 by stating the conclusion from each test.

**Table 1.1**

test	result	conclusion
iodine solution	changes to blue-black	
heated with Benedict's solution	remains blue	

[2]

[Total: 7]

2 A student cuts a potato into cylinders as shown in Fig. 2.1.



Fig. 2.1

The student states:

**When the potato cylinders are put into salt solution, the concentration of salt solution will affect the length of the potato cylinder but not the mass.**

Plan an investigation to test whether this statement is correct.

In your plan, include:

- the apparatus needed, including a labelled diagram if you wish
- a brief description of the method, including how you will treat variables and any safety precautions
- the measurements you will make
- how you will process your results to draw a conclusion.

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..... [7]

- 3 A student investigates the change in temperature which occurs when sodium carbonate and ammonium nitrate dissolve in water.

(a)

- She places 25 cm<sup>3</sup> distilled water into a polystyrene cup.
- She measures the temperature of the water and records this initial temperature in Table 3.1.
- She adds 2 g of sodium carbonate and stirs the mixture.
- She measures the highest or lowest temperature reached and records it in Table 3.1.
- She washes out the polystyrene cup.
- She repeats the experiment using 4 g and then 5 g of sodium carbonate.
- She repeats the experiment using 2 g, then 4 g and then 5 g of ammonium nitrate recording the temperatures in Table 3.2.

**Table 3.1**

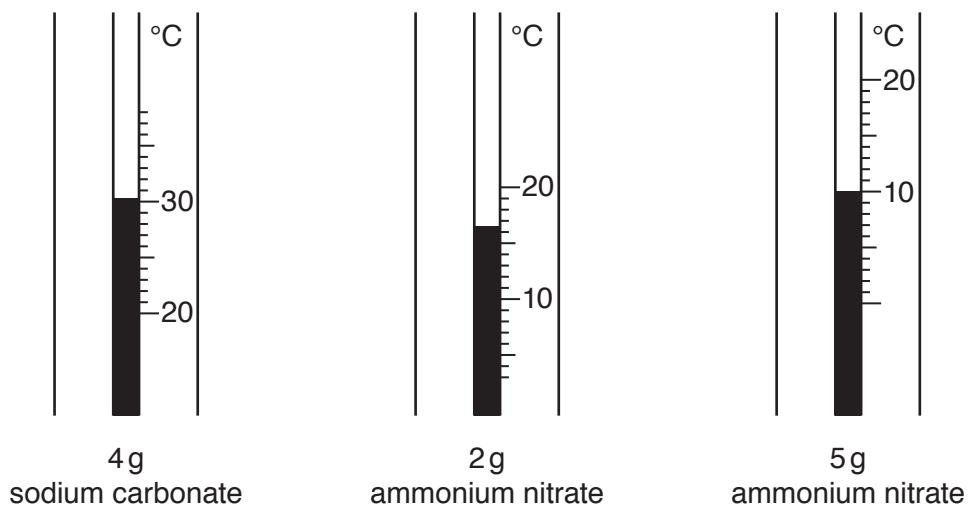
mass sodium carbonate/g	initial temperature/°C	highest or lowest temperature/°C	change in temperature /°C
2	20.0	25.0	
4	20.5		
5	19.5	34.5	

**Table 3.2**

mass ammonium nitrate/g	initial temperature/°C	highest or lowest temperature/°C	change in temperature /°C
2	20.5		
4	20.0	12.0	
5	20.0		

- (i) Fig. 3.1 shows the thermometer scales for the highest or lowest temperature reached for 4 g sodium carbonate, 2 g ammonium nitrate and 5 g ammonium nitrate.

Read the temperatures to the nearest 0.5°C and record them in Tables 3.1 and 3.2. [3]

**Fig. 3.1**

- (ii) Calculate the change in temperature for each experiment. Record these values, to the nearest  $0.5^{\circ}\text{C}$  in Table 3.1 and Table 3.2.

Put a + sign before the values for an increase in temperature and a – sign before the values for a decrease in temperature. [1]

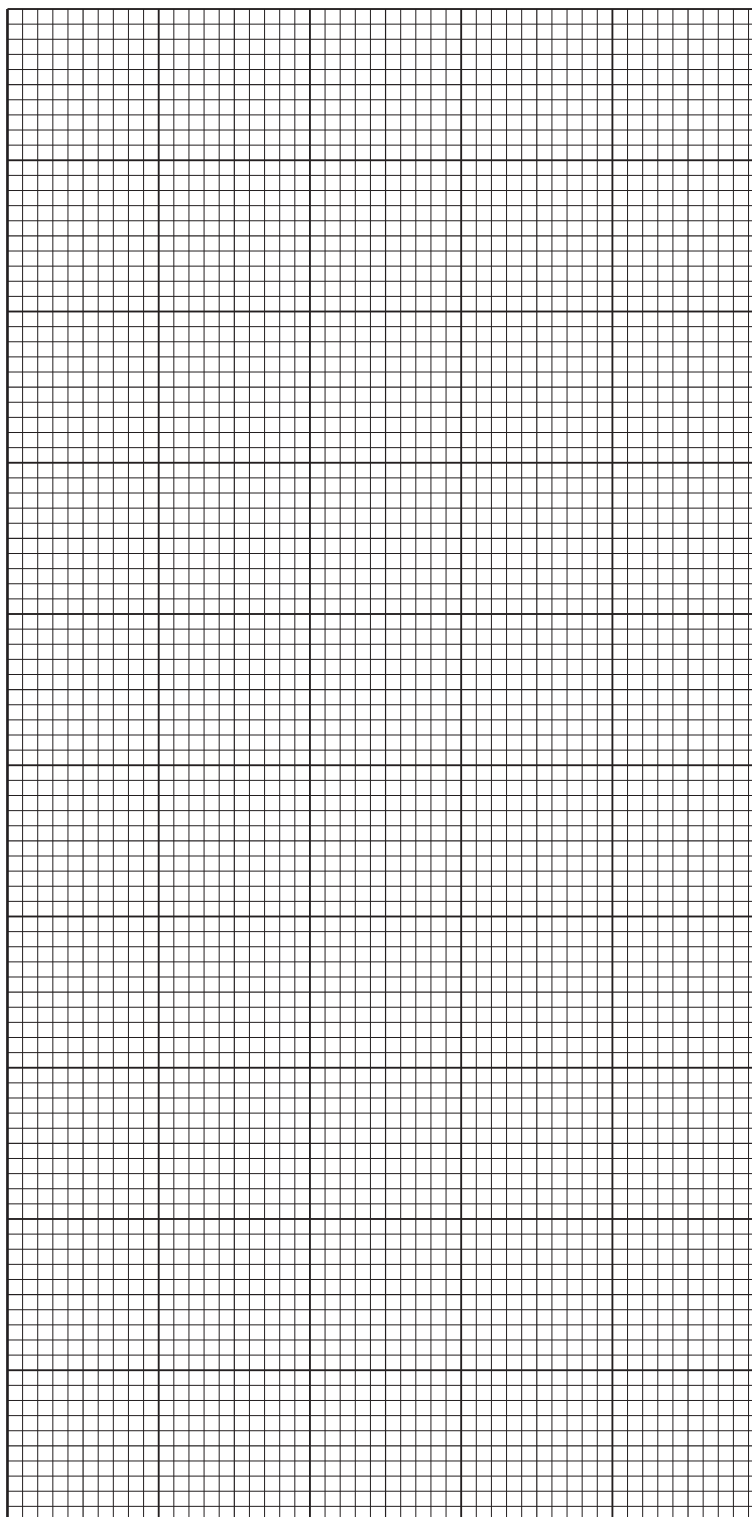
- (b) Stirring the mixture helps the solid to dissolve. Give **one** other reason why the mixture is stirred.

.....  
..... [1]



- (c) (i) On the grid provided, plot the change in temperature (vertical axis) against mass of solid for both sodium carbonate and ammonium nitrate. [2]

change in  
temperature  
/ °C



mass of solid / g

- (ii) Draw a straight line of best-fit for sodium carbonate and label the line S. [1]
- (iii) Draw a straight line of best-fit for ammonium nitrate and label the line A. [1]

- (d) (i) Use your graph to determine the change in temperature which would occur if 3g of sodium carbonate were added to 25 cm<sup>3</sup> distilled water.  
Show clearly on your graph how you arrived at your answer.

..... °C [1]

- (ii) Predict what change in temperature you would expect if 3g of ammonium nitrate were added to **50 cm<sup>3</sup> distilled water**.  
Explain how you arrived at your answer.

temperature change ..... °C

explanation .....

..... [2]

- (e) Another student repeats this experiment using potassium carbonate. The graph of his results is shown in Fig. 3.2.

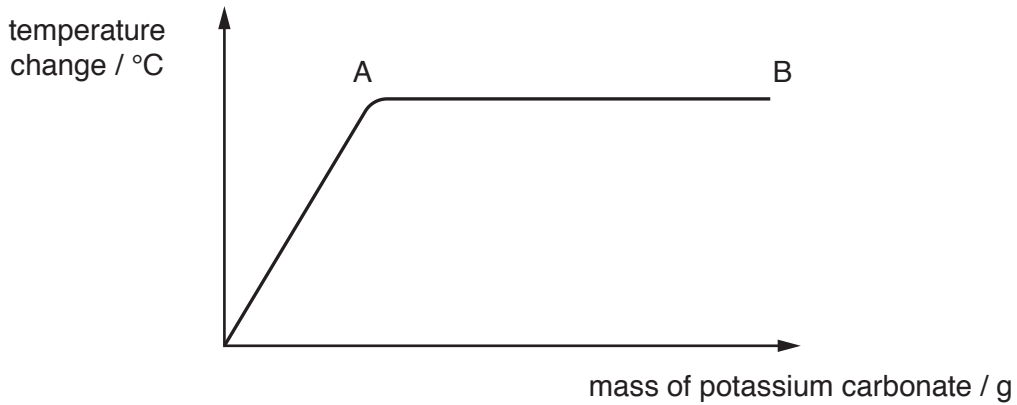


Fig. 3.2

Suggest why the graph gives no further increase in temperature between points A and B.

.....  
..... [1]

[Total: 13]

4 A student investigates the spring constant of different combinations of identical springs. The spring constant  $k$  of a spring is a measure of the spring's stiffness.

- (a) (i) Fig. 4.1 shows one unstretched spring. Measure and record the unstretched length  $l_0$  of the spring to the nearest mm. Do not include the loops at the end of the spring in your measurement.

$l_0 = \dots\dots\dots$  mm [1]

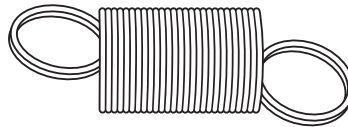


Fig. 4.1

- (ii) The student attaches the spring to a clamp and hangs a 300g mass from the spring as shown in Fig. 4.2.

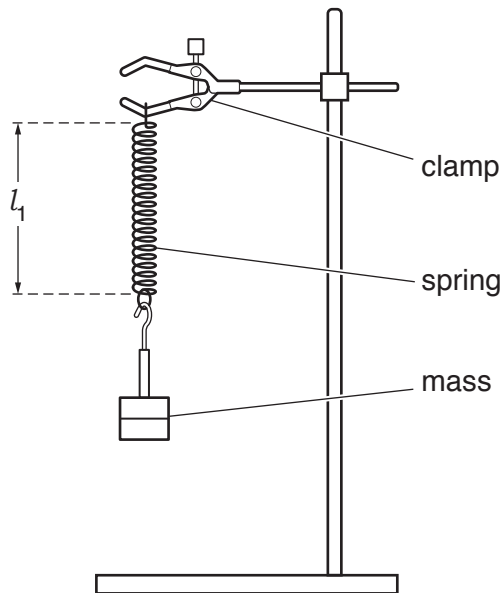


Fig. 4.2

She measures the new length  $l_1$  of the spring to the nearest mm.

$l_1 = 133$  mm

Describe how the student can avoid a parallax (line of sight) error when measuring the length  $l_1$  of the spring. You may include a diagram in your description.

.....

..... [1]

- (b) (i) Calculate the extension  $x$  of the spring.  
Use your answer to (a)(i), the student's value of  $l_1$  and the equation shown.

$$x = l_1 - l_0$$

$$x = \dots\dots\dots \text{ mm [1]}$$

- (ii) A mass of 1.0 kg has a weight of 10 N. Determine the weight  $w$  of the 300 g mass.

$$w = \dots\dots\dots \text{ N [1]}$$

- (iii) Calculate the spring constant  $k$  of the spring.  
Use your answers to (b)(i), (b)(ii) and the equation shown.

$$k = \frac{W}{x}$$

$$k = \dots\dots\dots \text{ N/mm [1]}$$

- (c) The student attaches a second spring to the clamp in parallel with the first spring.  
She hangs the 300 g mass from both springs as shown in Fig. 4.3.

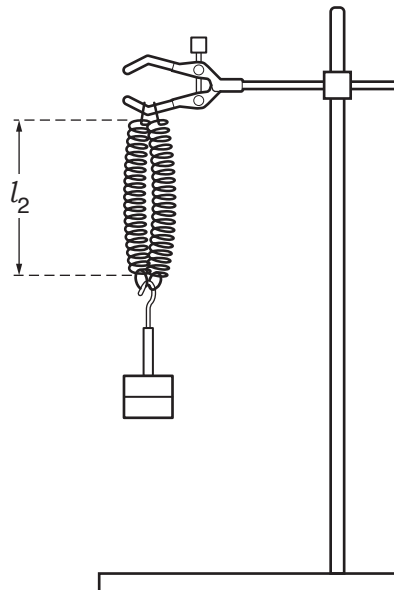


Fig. 4.3

She measures the new length  $l_2$  of the springs.

$$l_2 = 73 \text{ mm}$$

- (i) Calculate and record the extension  $x_p$  of the springs. Use your value of  $l_0$  from (a)(i) and the equation shown.

$$x_p = l_2 - l_0$$

$$x_p = \dots\dots\dots \text{ mm [1]}$$

(ii) Calculate the spring constant  $k_p$  for the two springs in parallel.

Use your answers from (b)(ii), (c)(i) and the equation shown.

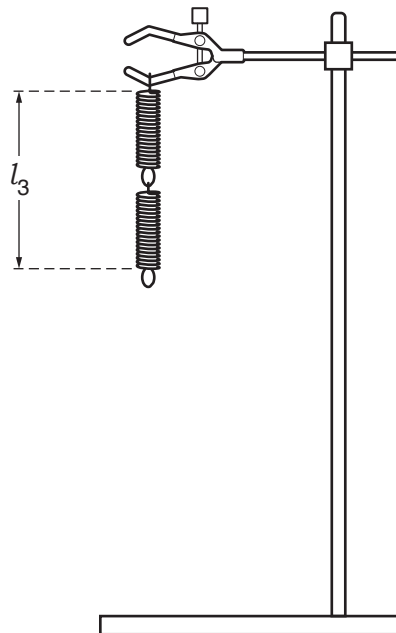
Give your answer to an appropriate number of significant figures.

$$k_p = \frac{W}{x_p}$$

$$k_p = \dots\dots\dots \text{ N/mm [2]}$$

(d)

- The student removes the springs from the clamp and joins them together in series.
- She measures the unstretched length  $l_3$  of the two springs joined together in series, as shown in Fig. 4.4.



$$l_3 = 64 \text{ mm}$$

**Fig. 4.4**

- She attaches the springs to the clamp and hangs the 300 g mass from the bottom spring as shown in Fig. 4.5.

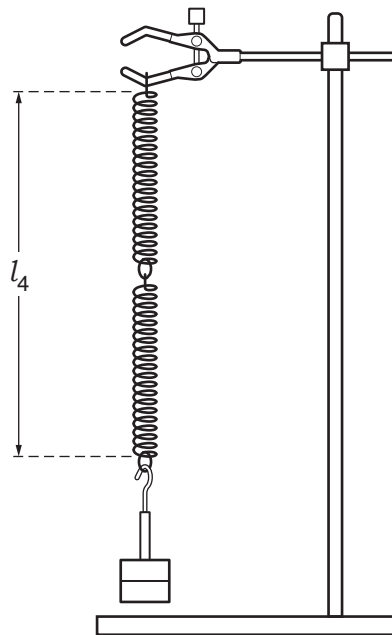


Fig. 4.5

- She measures the new length  $l_4$  of the springs in series.

$$l_4 = 291 \text{ mm}$$

- Calculate the total extension  $x_s$  of the springs. Use the equation shown.

$$x_s = l_4 - l_3$$

$$x_s = \dots\dots\dots \text{ mm}$$

- Calculate the spring constant  $k_s$  of the springs. Use the equation shown.

$$k_s = \frac{W}{x_s}$$

$$k_s = \dots\dots\dots \text{ N/mm [1]}$$

(e) A student predicts that  $k_p = 2k$  and that  $k_s = 0.5k$ .

- (i) Calculate the values of  $2k$  and  $0.5k$  using your value of  $k$  from (b)(iii).

$$2k = \dots\dots\dots \text{ N/mm}$$

$$0.5k = \dots\dots\dots \text{ N/mm [1]}$$

- (ii) Explain whether your values in (e)(i) agree with the student's prediction. In your answer, you should refer to experimental error.

.....  
..... [1]

- (f) Another student suggests that more accurate results could be obtained if a larger value of mass is used to hang from the springs throughout this investigation.

- (i) Explain how using a larger mass can improve the accuracy of the results.

.....  
..... [1]

- (ii) Suggest why using a much larger mass might **not** improve the accuracy of the results.

.....  
..... [1]

[Total: 13]

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