



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

CANDIDATE NAME

CENTRE NUMBER 

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**COMBINED SCIENCE**

**0653/52**

Paper 5 Practical Test

**February/March 2019**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

**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.  
Notes for Use in Qualitative Analysis for this paper are printed on page 16.

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.

For Examiner's Use	
<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>4</b>	
<b>Total</b>	

This document consists of **13** printed pages and **3** blank pages.

1 You are going to investigate seeds which were germinated at different temperatures. All other conditions were kept the same.

(a) Dish **A** and dish **B** contain seeds that have been germinated at two different temperatures.

The temperatures at which each dish was kept are shown in Fig. 1.1.

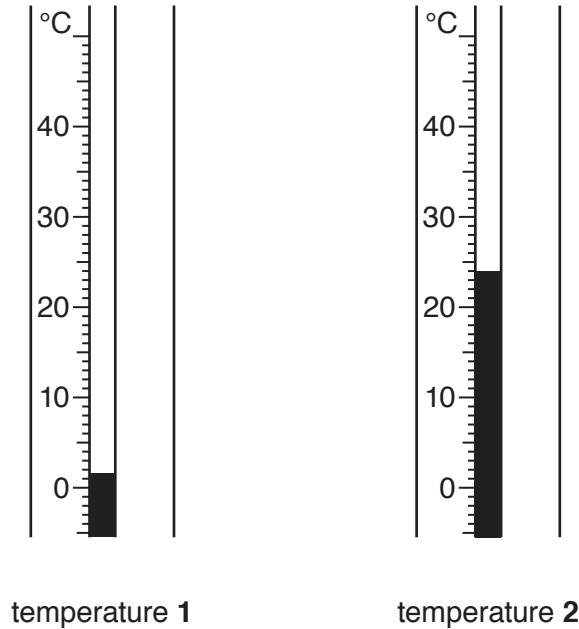


Fig. 1.1

(i) Read the two temperatures shown in Fig. 1.1.

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** carefully.

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) Carefully remove three of the germinated seeds from dish **B** and place them on a white tile.

(i) Use a ruler to measure the length, in millimetres, of each seedling.

Take your measurement from the tip of the shoot to the tip of the root.

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) Take some of the seeds from dish **A** and place them on a white tile.

Carefully crush these with a spatula and add a few drops of iodine solution.

colour observed after adding iodine solution .....

conclusion .....

..... [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.

**You are not required to carry out this investigation.**

In your answer, 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.



3 You are going to investigate the change in temperature which occurs when sodium carbonate and ammonium nitrate dissolve in water.

- (a) (i)
- Using a measuring cylinder, place 25 cm<sup>3</sup> distilled water into the polystyrene cup.
  - Place the polystyrene cup into the 250 cm<sup>3</sup> beaker. This stops the cup from falling over.
  - Measure the temperature of the distilled water in the polystyrene cup. Record this initial temperature, to the nearest 0.5 °C, in Table 3.1.
  - Add 2 g of sodium carbonate to the distilled water in the polystyrene cup and immediately start the stop clock.
  - Stir the mixture continuously and after **one minute** measure the temperature of the mixture. Record this final temperature, to the nearest 0.5 °C, in Table 3.1.
  - Pour the mixture into the waste container.
  - Rinse the polystyrene cup with distilled water.
  - Repeat steps 1 to 7 using 4 g and then 5 g of sodium carbonate.
  - Repeat steps 1 to 8 using ammonium nitrate instead of sodium carbonate. Record the temperatures in Table 3.2.

**Table 3.1**

mass sodium carbonate/g	initial temperature/°C	final temperature /°C	change in temperature /°C
2			
4			
5			

**Table 3.2**

mass ammonium nitrate/g	initial temperature/°C	final temperature /°C	change in temperature /°C
2			
4			
5			

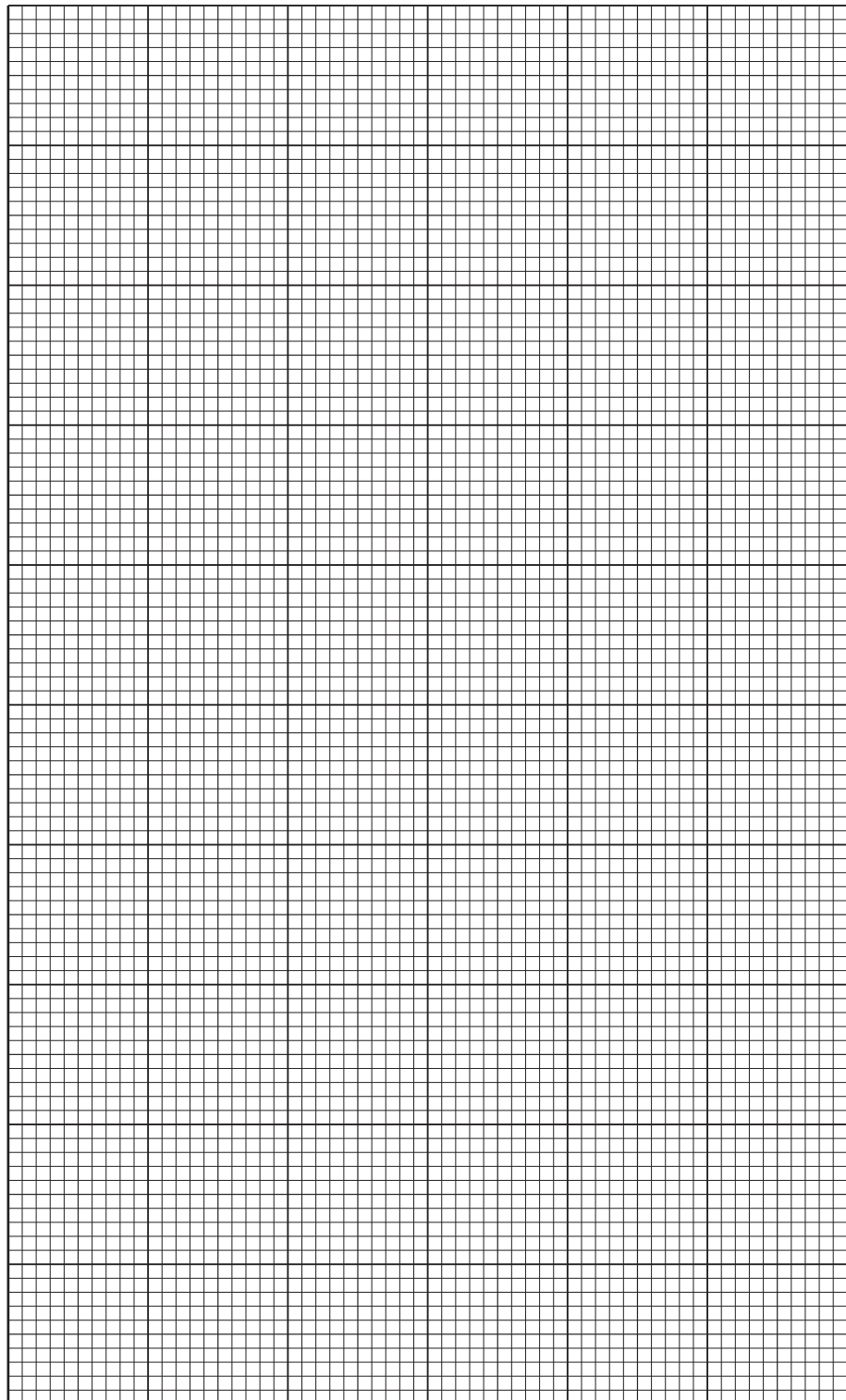
[4]

- (ii) Calculate the change in temperature for each mass of sodium carbonate and each mass of ammonium nitrate. Record these, to the nearest 0.5 °C in Table 3.1 and Table 3.2.

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

- (b) (i) On the grid provided, plot the change in temperature (vertical axis) against mass 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]

- (c) (i) Use your graph to determine the change in temperature which would occur if 3 g of sodium carbonate is added to 25 cm<sup>3</sup> distilled water.

Show clearly on your graph how you arrived at your answer.

..... °C [1]

- (ii) Predict the change in temperature you would expect if 3 g of ammonium nitrate is added to **50 cm<sup>3</sup> distilled water**.

Explain how you arrived at your answer.

temperature change ..... °C

explanation .....

..... [2]

- (d) Suggest **one** change you could make to the apparatus used in the experiments to make the measurements more accurate.

.....

..... [1]

[Total: 13]



4 You are going to find 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) Measure the unstretched length  $l_0$  of one of the springs 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]

- Attach this spring to the clamp.
- Hang a 300 g mass on the spring as shown in Fig. 4.1.

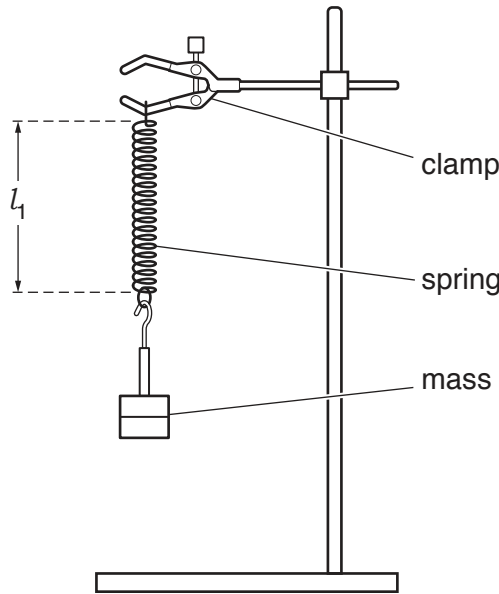


Fig. 4.1

(ii) Measure the new length  $l_1$  of the spring to the nearest mm.

$l_1 = \dots\dots\dots$  mm [1]

(iii) Describe how you avoided 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 answers to (a)(i) and (a)(ii) 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 answer to (b)(i) and (b)(ii) and the equation shown.

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

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

- (c) Attach the second spring to the clamp in parallel with the first spring.  
Hang the 300 g mass from both springs as shown in Fig. 4.2.

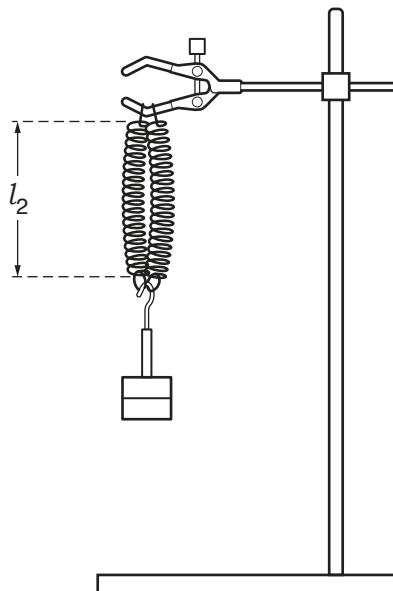


Fig. 4.2

- (i) Measure the new length  $l_2$  of **your** springs to the nearest mm.

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

Calculate the extension  $x_p$  of the springs. Use 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) and (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)

- Remove the springs from the clamp.
- Join the springs together in series by pushing a loop of one spring through a loop of the other spring.
- Attach the springs to the clamp as shown in Fig. 4.3.

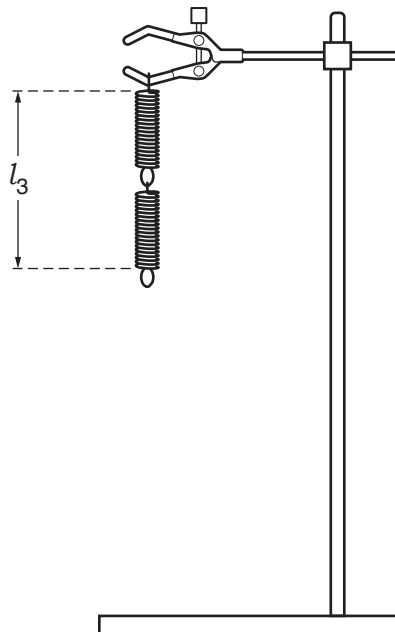


Fig. 4.3

- (i) Measure the unstretched length  $l_3$  of **your** two springs, joined together in series, to the nearest mm.

$$l_3 = \dots\dots\dots \text{ mm [1]}$$

(ii) Hang the 300 g mass from the bottom spring as shown in Fig. 4.4.

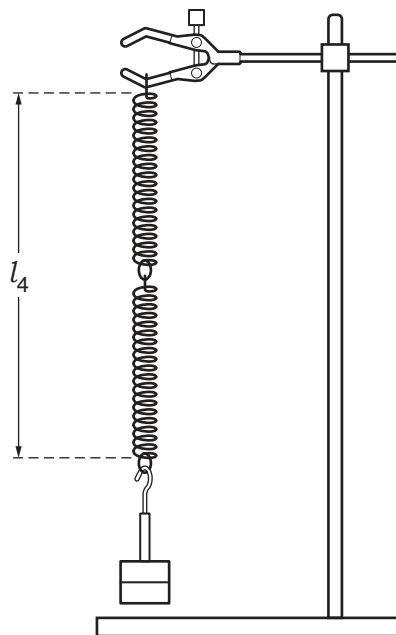


Fig. 4.4

Measure the new length  $l_4$  of **your** springs joined together.

$l_4 = \dots\dots\dots$  mm

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

$$x_s = l_4 - l_3$$

$x_s = \dots\dots\dots$  mm

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

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

$k_s = \dots\dots\dots$  N/mm [1]

(e) A student predicts that  $k_p = 2k$  and that  $k_s = 0.5k$ .  
Suggest whether your results support this prediction.  
Explain your answer.

.....  
 .....  
 ..... [2]

[Total: 13]







## NOTES FOR USE IN QUALITATIVE ANALYSIS

## Tests for anions

<i>anion</i>	<i>test</i>	<i>test result</i>
carbonate ( $\text{CO}_3^{2-}$ )	add dilute acid	effervescence, carbon dioxide produced
chloride ( $\text{Cl}^-$ ) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
nitrate ( $\text{NO}_3^-$ ) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate ( $\text{SO}_4^{2-}$ ) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

## Tests for aqueous cations

<i>cation</i>	<i>effect of aqueous sodium hydroxide</i>	<i>effect of aqueous ammonia</i>
ammonium ( $\text{NH}_4^+$ )	ammonia produced on warming	–
calcium ( $\text{Ca}^{2+}$ )	white ppt., insoluble in excess	no ppt. or very slight white ppt.
copper(II) ( $\text{Cu}^{2+}$ )	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II) ( $\text{Fe}^{2+}$ )	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) ( $\text{Fe}^{3+}$ )	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc ( $\text{Zn}^{2+}$ )	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

## Tests for gases

<i>gas</i>	<i>test and test result</i>
ammonia ( $\text{NH}_3$ )	turns damp red litmus paper blue
carbon dioxide ( $\text{CO}_2$ )	turns limewater milky
chlorine ( $\text{Cl}_2$ )	bleaches damp litmus paper
hydrogen ( $\text{H}_2$ )	'pops' with a lighted splint
oxygen ( $\text{O}_2$ )	relights a glowing splint

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