Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

9596861142

COMBINED SCIENCE **0653/62**

Paper 6 Alternative to Practical **May/June 2016**

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 **19** printed pages and **1** blank page.

CAMBRIDGE International Examinations

1 A student investigates the food content of peas and sweetcorn using the tests shown in Table 1.1.

(a) Complete the second **row** of Table 1.1 to show the food group that can be identified by each of the tests. [2]

The student carries out the following procedure.

- She places five peas in each of three test-tubes.
- She gently crushes the peas in each test-tube with a glass rod.
- She adds Benedict's solution to one test-tube and then places it in a hot water-bath for a few minutes.
- She adds biuret solution to the second test-tube.
- She adds a few drops of iodine solution to the third test-tube.

She repeats the procedure with sweetcorn using three new test-tubes.

(b) Explain why the peas and sweetcorn are crushed before carrying out the tests.

.....[1]

(c) The student makes the following observations:

- the peas test positive for starch
- the sweetcorn tests positive for starch and a **small** amount of reducing sugar
- all other observations are negative results.

Complete Table 1.1 to show the results of the tests that match the student's observations. [3]

Table 1.1

	Benedict's test	biuret test	iodine test
food group tested for			
colour obtained with peas			
colour obtained with sweetcorn			

(d) Plan an investigation to test for the presence of fat in peas and sweetcorn.

You should include the following in your plan:

- what you will do
- the reagents you will use
- any safety precautions you will take
- the observations you will make that would indicate the presence of fat.

.....

.....

.....

.....

.....

.....[4]

2 A student is told that solids **D**, **E** and **F** have the same metal cation, but different anions.

He is provided with:

ammonia solution
barium chloride solution
distilled water
limewater
silver nitrate solution

(a) Identifying the cation

Describe how the student can identify the metal cation present in **D** using liquids from the list above.

State how the observation leads to the identity of the metal cation.

test .....

.....

observations .....

.....

[3]

(b) Identifying the anion in D

(i) The student places solid **D** in a hard glass test-tube and connects this to a test-tube one quarter full of limewater using a delivery tube.

Draw a labelled diagram of this apparatus connected together.

[2]

(ii) The student then heats the hard glass test-tube in the apparatus as in **(b)(i)**.

He stops heating when there is no further change in the limewater.

Table 2.1 shows his observations.

Table 2.1

observation of solid **D**	observation of limewater
green to black	white ppt. which then disappears giving a colourless solution

Use the observations in Table 2.1 to state what can be concluded about the anion in solid **D**.

conclusion .....

..... [1]

(c) Identifying the anions in E and F

The student makes a solution of solid **E** in distilled water. He divides this solution between two test-tubes.

- to one test-tube of solution **E** he adds barium chloride solution
- to the other test-tube he adds silver nitrate solution
- he records his observations in Table 2.2

He then repeats the procedure for solid **F**. The observations are shown in Table 2.2.

Table 2.2

	solution of **E**	solution of **F**
barium chloride solution	white ppt.	no reaction
silver nitrate solution	no reaction	white ppt.

Use the observations in Table 2.2 to identify the anions in solids **E** and **F**.

anion in **E** .....

anion in **F** .....

[2]

(d) Suggest a different reagent, **not** listed on page 4, that could be used to identify the metal cation.

State the expected observation for your chosen reagent if the metal cation in **D**, **E** and **F** is Cu^{2+}.

reagent .....

expected observation .....

[2]

Please turn over for Question 3.

3 A student carries out an experiment to investigate two different methods of insulating a beaker of water. Fig. 3.1. shows the apparatus used.

Beaker **P** has a layer of insulation wrapped around it, but has no lid.

Beaker **Q** has a lid, but no insulation.

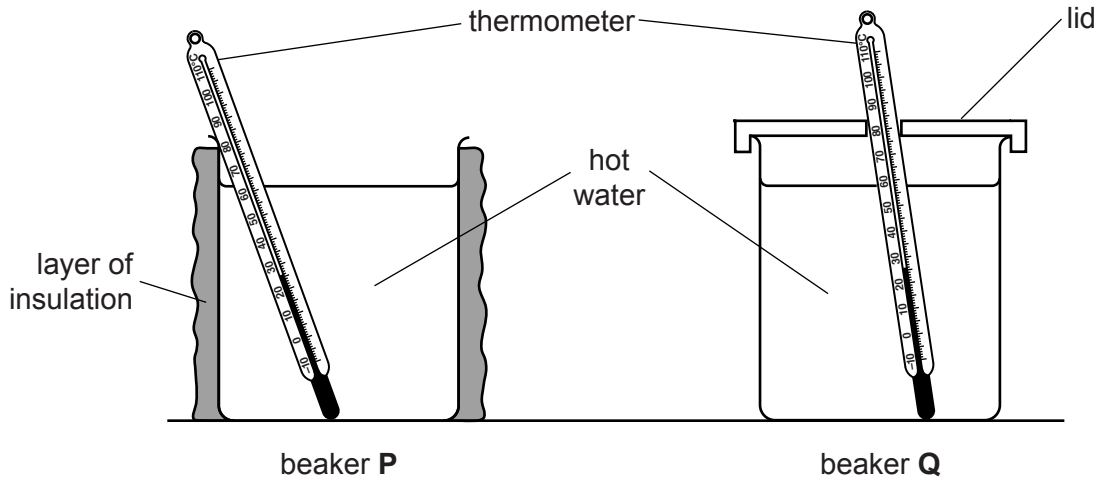


Fig. 3.1

The student carries out the following procedure.

- He pours 200 cm^3 of hot water into beaker **P**.
- He places the thermometer into the water and when the reading stops rising, measures the temperature *T* of the hot water and starts a stopwatch.
- He then measures the temperature of the hot water every 30 s for 180 s.

The student repeats the procedure with beaker **Q**. Table 3.1 shows his results.

Table 3.1

	beaker **P**	beaker **Q**
time *t* /	temperature *T* /	
0	83.5	85.0
30	81.5	83.5
60	80.0	82.5
90	78.5	81.0
120		80.0
150	76.0	79.0
180	75.0	78.5

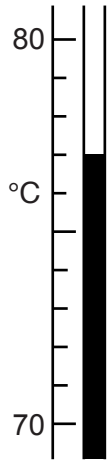


Fig. 3.2

(a) Read the temperature shown by the thermometer in Fig. 3.2, and record it at time t = 120 in Table 3.1, to the nearest 0.5°C. [1]

(b) Complete the headings in Table 3.1 by inserting the units. [1]

(c) **(i)** Calculate the fall in temperature T_P of the hot water in beaker **P** over the 180 s.

T_P = ... [1]

(ii) Calculate the average rate of fall in temperature R_P of the hot water in beaker **P** over the 180 s, using the equation shown.

$$R_P = \frac{T_P}{180}$$

R_P = ... [1]

(d) **(i)** Calculate the fall in temperature T_Q of the hot water in beaker **Q** over the 180 s.

T_Q = ... [1]

(ii) Calculate the average rate of fall in temperature R_Q of the hot water in beaker **Q** over the 180 s.

R_Q = ...[1]

(e) State which is the more effective method of reducing thermal energy loss from a beaker of hot water. Explain your answer.

.....

.....[1]

(f) Apart from adding a lid, state **two** other ways that the student could have reduced the loss of thermal energy from beaker **P** even further.

1. .....

2. .....
[2]

(g) State **one** condition which he should control to ensure that the comparison between beaker **P** and beaker **Q** is fair.

.....[1]

Please turn over for Question 4.

4 A student investigates the effect of gravity on the growth of bean seedlings.

She sets up the apparatus shown in Fig. 4.1.

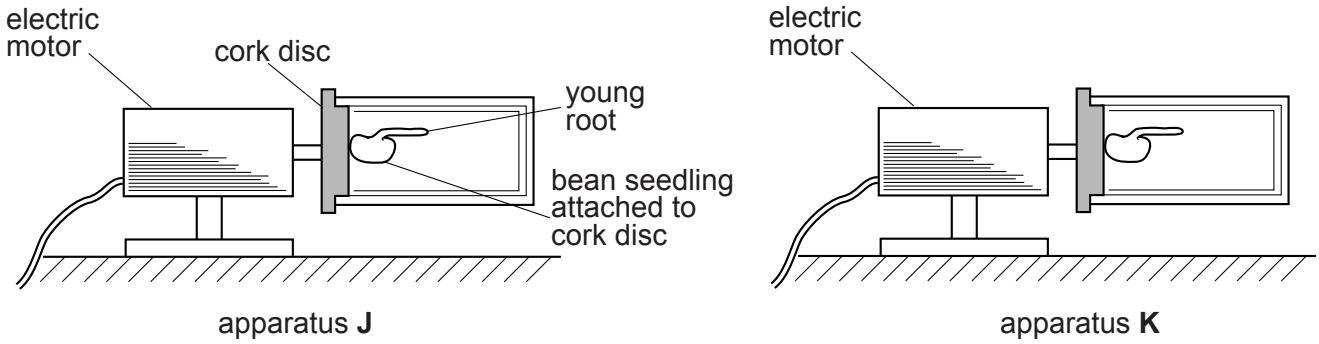


Fig. 4.1

When the electric motor in **J** is switched on the cork disc slowly rotates causing the bean seedling in **J** to rotate. She keeps the motor in apparatus **K** switched **off** throughout the experiment.

(a) Name the type of response that the student is investigating.

..... [1]

(b) Apparatus **J** is a control.

Fig. 4.2 shows the appearance of the young root for apparatus **J** after six days' growth.

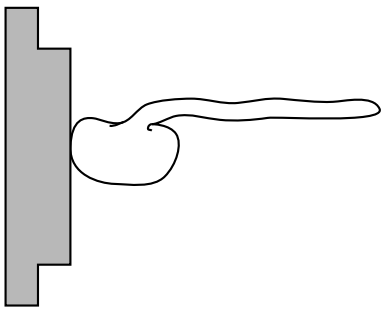


Fig. 4.2

(i) Describe how the young root grew in **J** over this six-day period.

.....

..... [1]

(ii) Explain this pattern of growth.

.....

..... [1]

(c) Fig. 4.3 shows the bean seedling in apparatus **K**.

On Fig. 4.3, show the likely appearance of the seedling after the six days by drawing the young root. [2]

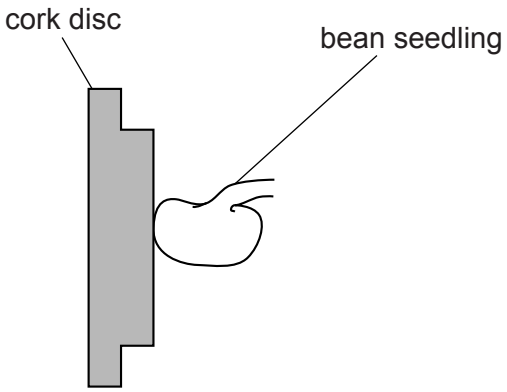


Fig. 4.3

(d) The teacher says that the results of this experiment are **not** reliable. Explain why the results may **not** be reliable.

..... [1]

(e) A few days later, the bean seedling in apparatus **K** produces a young stem. The apparatus is placed in the dark for a further six days. Predict how the stem will grow during this time.

..... [1]

(f) The bean seedlings were obtained by germinating bean seeds. Describe how this can be done in a laboratory.

.....

.....

.....

..... [3]

5 A student uses the energy change in the reaction between hydrochloric acid and sodium hydroxide solution to find the concentration of the sodium hydroxide solution. She carries out the following procedure.

(a) step **1** She places 50 cm^3 of hydrochloric acid (this is volume, V_1) of known concentration C_1 in a flask.

step **2** She measures the initial temperature of the hydrochloric acid and leaves the thermometer in the flask.

step **3** She records this temperature in Table 5.1 for zero volume of sodium hydroxide solution added.

step **4** She adds 10 cm^3 of sodium hydroxide solution at room temperature to the acid in the flask, stirs and records in Table 5.1 the highest temperature measured.

step **5** When the temperature stops changing, she immediately adds a further 10 cm^3 of sodium hydroxide solution to the acid in the flask, stirs and records in Table 5.1 the highest temperature measured.

step **6** She repeats step **5** three more times until she has added a total of 50 cm^3 sodium hydroxide solution.

Table 5.1

volume of sodium hydroxide solution added each time / cm^3	total volume of sodium hydroxide solution added / cm^3	temperature, T / °C	change in temperature, ΔT / °C
0	0	20.0	0.0
10	10	26.0	
10	20	30.0	10.0
10	30	32.5	12.5
10	40	31.0	11.0
10	50	30.0	

(i) Name a suitable piece of apparatus for measuring the volume of the hydrochloric acid in step **1**.

.....[1]

(ii) Explain why the student stirs the mixture after the addition of each 10 cm^3 of sodium hydroxide solution.

.....

.....[1]

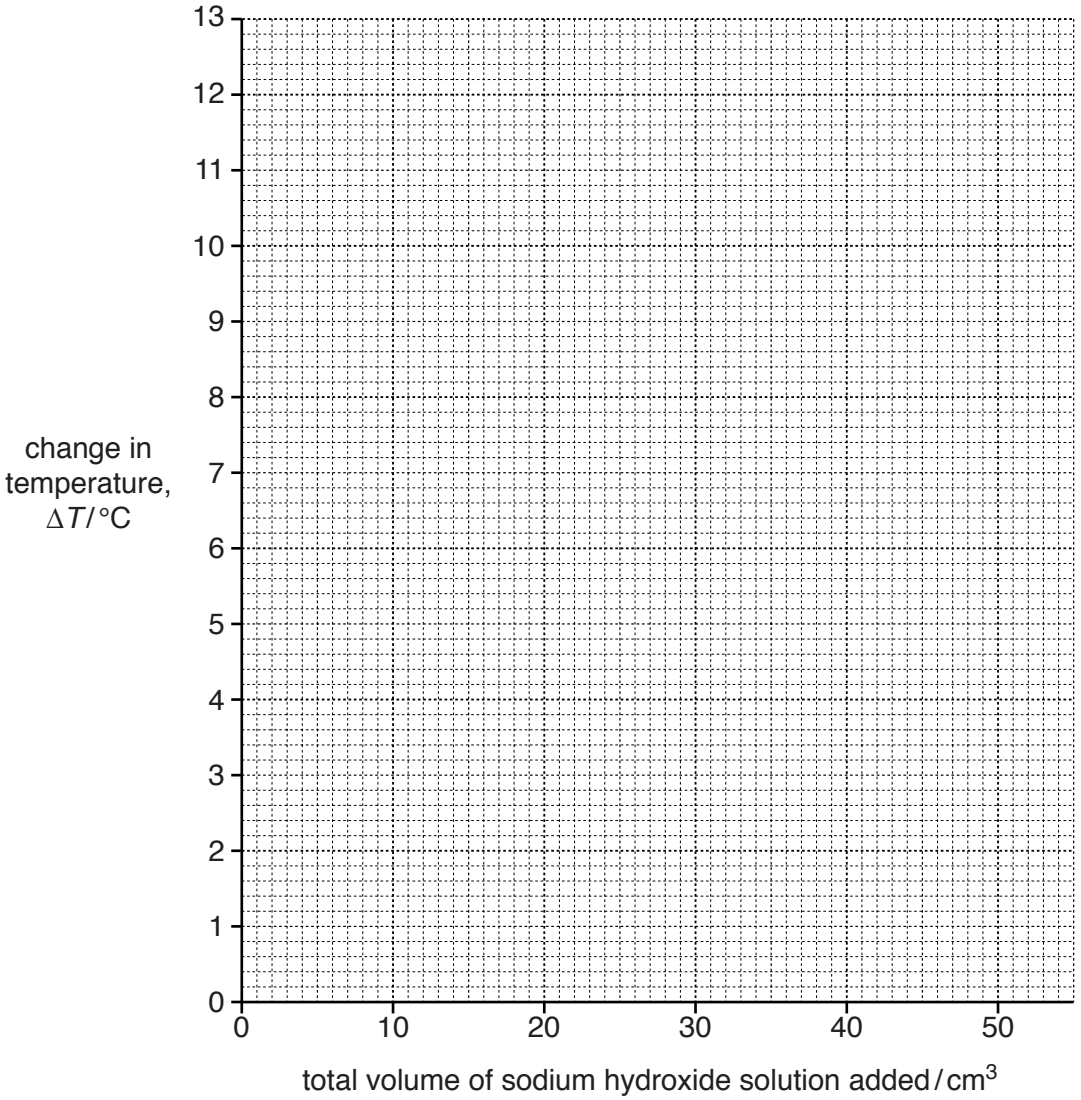
(iii) This reaction is exothermic. Explain why the temperature drops when a total of 40 cm^3 of sodium hydroxide solution has been added.

.....

.....[1]

(b) (i) Complete Table 5.1 by calculating the change in temperature, ΔT for each addition of 10 cm^3 sodium hydroxide solution compared with the initial temperature of 20.0 °C. Three have been done for you. [1]

(ii) Plot a graph of change in temperature against total volume of sodium hydroxide solution added. Draw the best-fit curve. [2]



(iii) Draw a vertical line from the maximum on your curve down to the horizontal axis.

Where this line meets the horizontal axis is the total volume of sodium hydroxide solution added to the acid which gives the maximum change in temperature. Record this volume which is V_2.

V_2 = ...[1]

(iv) Use the data in **(a)** and the formula shown to calculate the concentration of the sodium hydroxide solution C_2 used.

$$C_2 = \frac{2V_1}{V_2}$$

C_2 = ...[1]

(c) The teacher suggests that the values obtained for V_2 and C_2 may **not** be accurate using this method.

Suggest how the **experiment** could be modified to obtain more accurate values of V_2 and C_2. State the values of any volumes you would use.

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.....

.....

[2]

6 **(a)** A student investigates the absorption of infra-red radiation by different surfaces.

Fig. 6.1 shows the apparatus used.

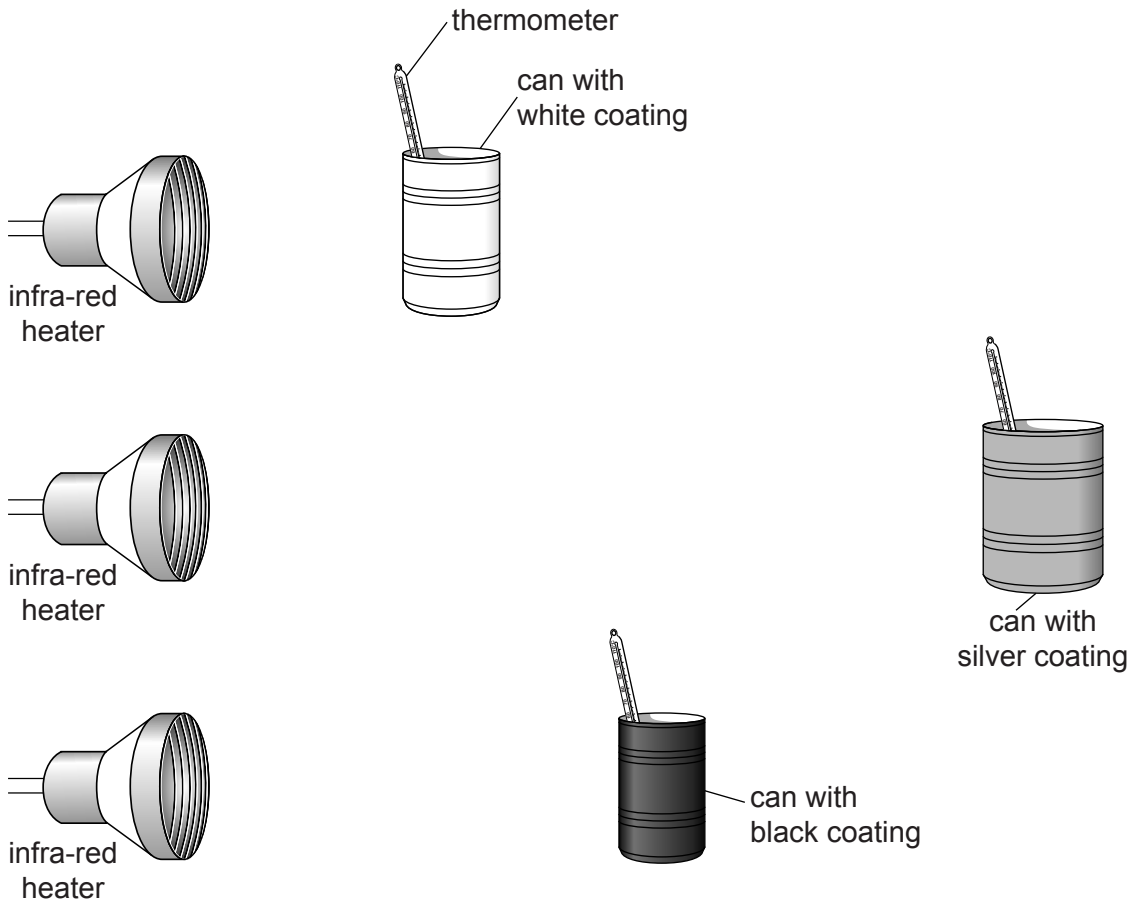


Fig. 6.1

The student adds some water to each can.

He uses a thermometer to measure the temperature of the water in each can. These temperature readings are shown in the first row of Table 6.1, on page 18, at time = 0.

Table 6.1

	temperature / °C		
time / min	silver coating	white coating	black coating
0	21	21	21
2	22	23	24
4	23	24	27
6	26	28	33
8	31	34	40
10			50

The student switches on the infra-red heaters at the same time and starts a stopclock.

He takes the temperature of the water in each can every 2 minutes for 10 minutes.

Fig. 6.2 shows the thermometers for the water in the can with the silver coating and the can with the white coating at 10 minutes.

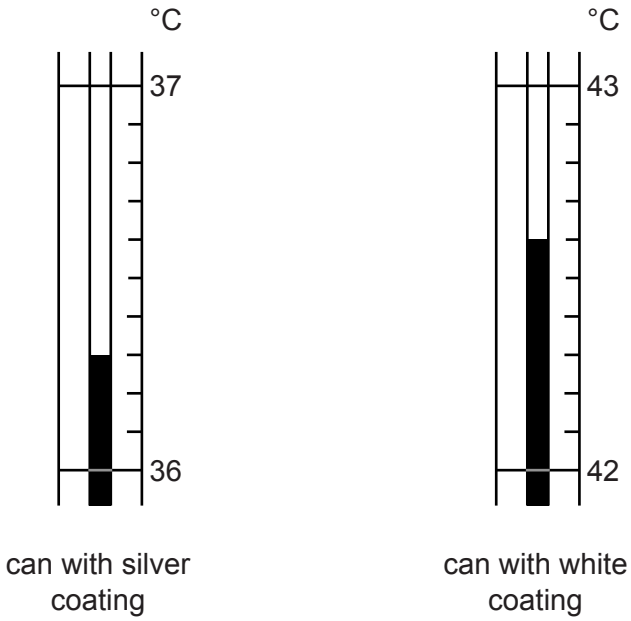
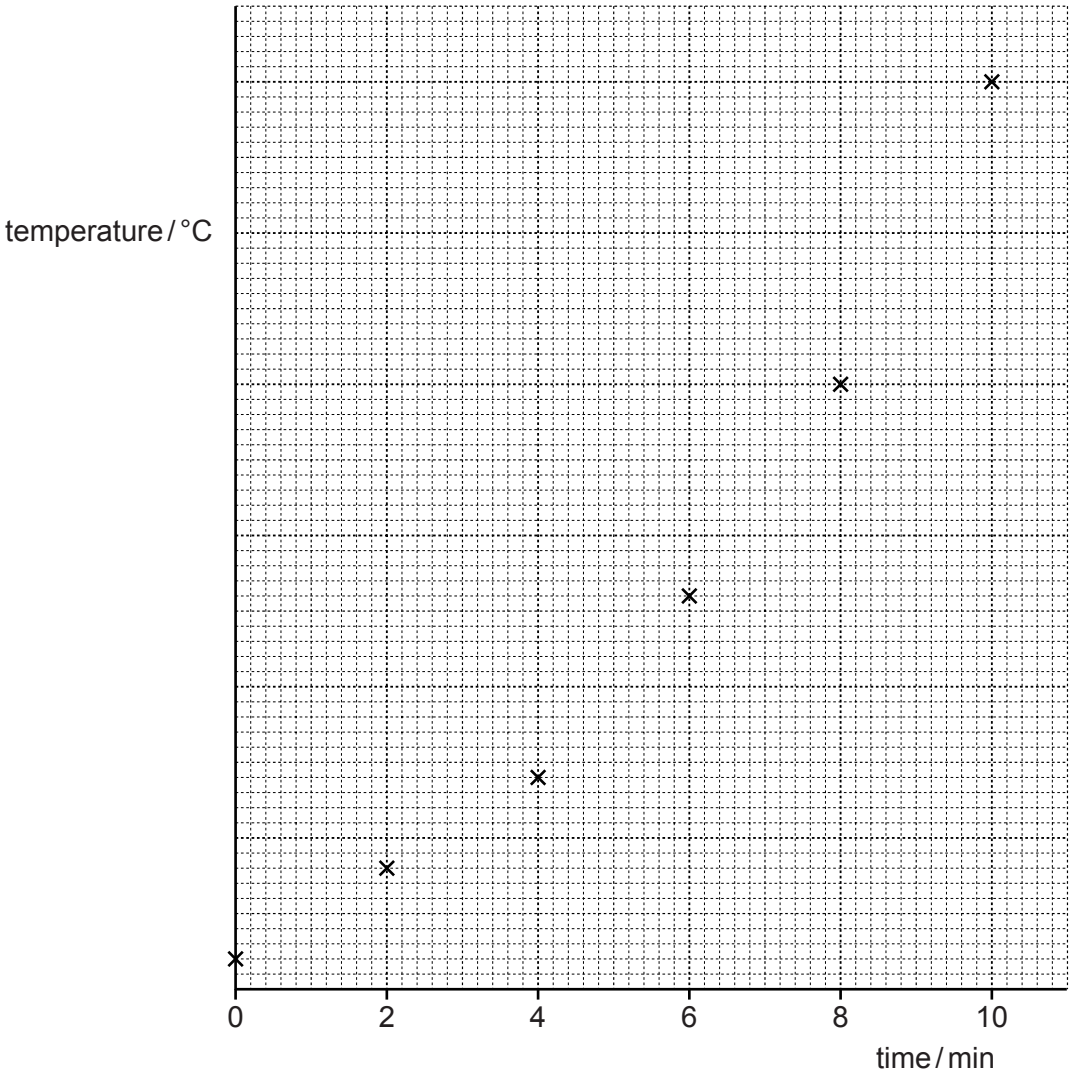


Fig. 6.2

(i) Read the scales and record the values in Table 6.1 to the nearest 1 °C. [2]

The student plots a graph of temperature against time for the can with the **black** coating as shown.

(ii) Using Table 6.1 and the points plotted, add the scale to the vertical axis. The scale **does not start** at 0. [1]



(iii) Complete the graph by plotting the points for the can with the silver coating **and** the can with the white coating.

Draw the best-fit curve for each of the cans. Label all three lines appropriately. [4]

(b) The teacher says the results are **not** very reliable.

State **three** things the student can change to improve the reliability of the results.

1.....

2.....

3..... [3]

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