



General Certificate of Secondary Education
2023

Centre Number

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Candidate Number

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Single Award Science

Unit 4

Booklet A

Foundation Tier

[GSA41]

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.
Answer **both** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is **30**.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Follow all health and safety instructions.

You may use a ruler and calculator if required.

The apparatus and materials required to complete the task(s) are provided.

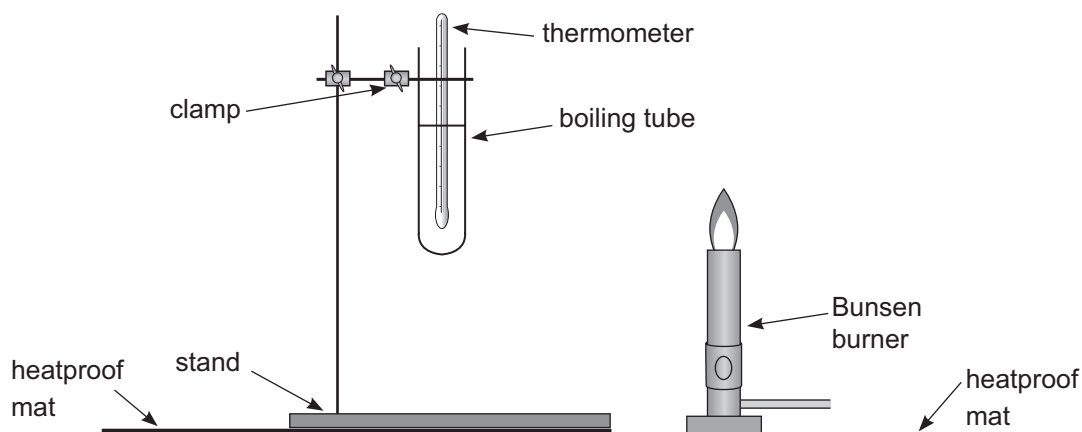
For Examiner's
use only

Question Number	Marks
1	
2	

Total
Marks

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- 1 (a) (i) The apparatus below can be used to investigate the energy content in crisps.



To find the energy content in a crisp, follow the method below.

1. Use the measuring cylinder to measure 20 cm^3 of water into the boiling tube.
2. Measure the starting temperature of the water and record this in the results table below.
3. Using tongs, hold one of the crisps (crisp 1) in the blue flame of the Bunsen burner until the crisp starts to burn.
4. Immediately put the burning crisp under the boiling tube until it is completely burnt. (If the crisp goes out, relight it in the Bunsen flame and put it back under the boiling tube.)
5. Measure the final temperature of the water and record this in the results table below.
6. After five minutes, change the boiling tube and repeat steps 1–5 using the other crisp (crisp 2).

Results table

Crisp	Starting temperature/ $^{\circ}\text{C}$	Final temperature/ $^{\circ}\text{C}$	
1			
2			

[1]

- (ii) Calculate the temperature rise for each crisp and record this in the last column of the table above.

[1]

- (iii) In the table above, add the **heading** and **unit** for the last column.

[2]

Examiner Only

Marks Remark

(iv) Calculate the average temperature rise for crisps 1 and 2.

_____°C [1]

(v) Why is it important to repeat and then average the results of an investigation?

Circle your answer.

to ensure accurate results

to ensure reliable results

to ensure valid results

[1]

(b) (i) In step 6, why was it important to wait for five minutes before changing the boiling tube?

_____ [1]

(ii) Suggest **one** reason why the Bunsen burner should be kept away from the boiling tube during this investigation.

_____ [1]

(iii) Suggest what effect, if any, using 40 cm³ of water would have on the temperature rise in this investigation.

Tick (✓) **one** answer.

larger temperature rise	
lower temperature rise	
same temperature rise	

[1]

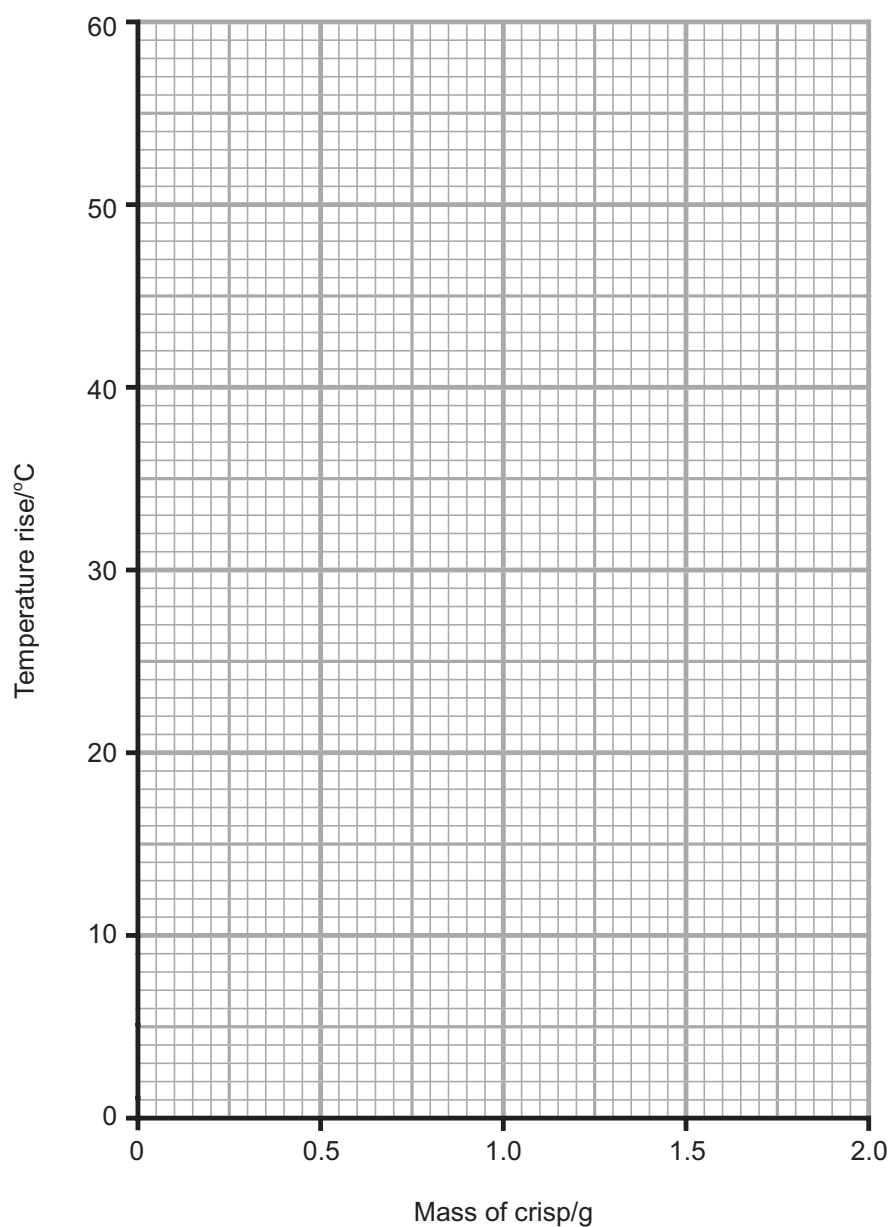
Examiner Only

Marks Remark

- (c)** The same method was used to investigate how changing the mass of the crisp affected the temperature rise.
The results are shown below.

Mass of crisp/g	Temperature rise/°C
0.5	25
1.0	33
1.5	43
2.0	56

- (i) On the grid below, plot and draw a **line graph** of these results.



[3]

- (ii) Complete the sentence below to describe the trend shown by these results.

As the mass of crisp _____
_____ [1]

- (iii) What is the independent variable in this investigation?

Circle your answer.

temperature rise : volume of water : mass of crisp
[1]

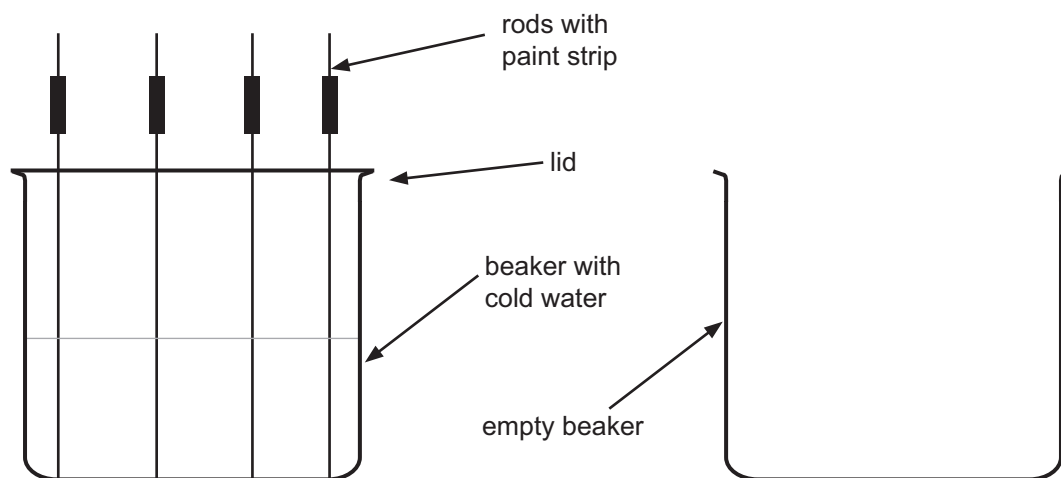
- (iv) Give **one** reason why all the energy released from the burning crisp does **not** go into heating the water.

_____ [1]

Examiner Only	
Marks	Remark

- 2 The diagram below shows the apparatus that can be used to compare how heat travels through four conductors.

Each rod has a strip of paint which will change colour when heated.



It is important that you read the method below carefully before starting the investigation.

(a) Carry out the investigation by following the method below.

1. Your teacher will add 50 cm³ of boiling water to the empty beaker.
2. Place the lid with rods into the boiling water as quickly as possible. (Make sure the bottom of each rod touches the bottom of the beaker.)
3. Start the stopwatch.
4. Time how long it takes for the paint to **start** to change colour on each rod.
NOTE: do not stop the stopwatch between readings.
5. Record each time, in **seconds**, in the table below.
6. Place the lid with rods back into the beaker of cold water for five minutes.
7. Pour out the boiling water.
8. Repeat steps 1–5 to get a second set of results.
9. Calculate the average time for the paint to start to change colour for each rod and record this in the final column of the table.

Note: 1 minute = 60 seconds

Rod material	Time for paint to start to change colour /s		Average time to change colour /s
	Trial 1	Trial 2	
copper			
aluminium			
brass			
steel			

Examiner Only	
Marks	Remark

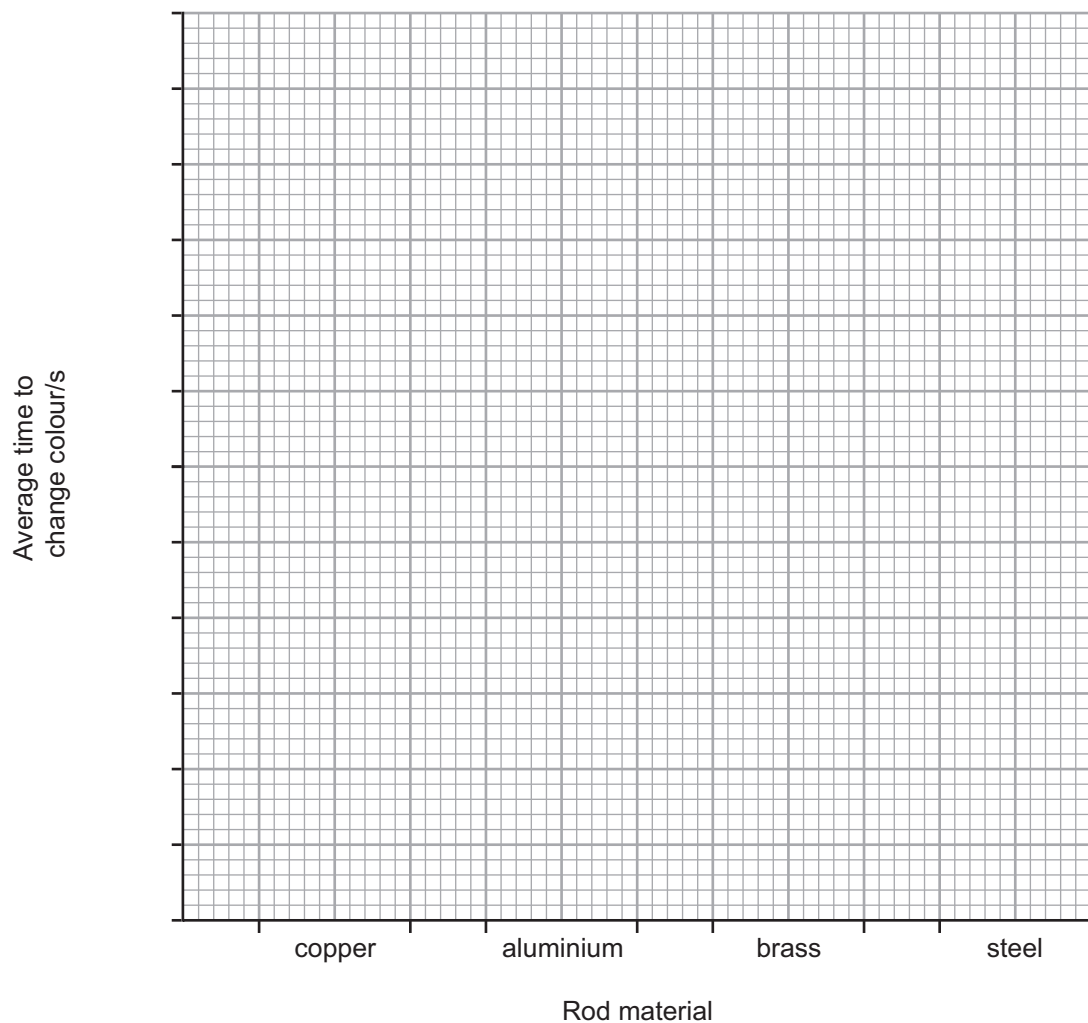
[3]

(b) What is the range of the average time for the paint to change colour?

_____s to _____s [1]

(c) Use the grid below to plot a bar chart of the **average** time taken for the paint to change colour on each rod.

Make sure that you add a suitable scale to the vertical axis.



[3]

- (d) (i) Use your results to place the metals in order of conductivity.
(Start with the best conductor.)

_____	Best conductor ↓

- (ii) Suggest how long it would take for the paint to start to change colour if a glass rod had been used in the investigation. [2]

_____ s [1]

- (e) State **two** ways this method ensured a fair investigation.

1. _____

2. _____
_____ [2]

- (f) In this investigation, the time for the paint to start to change colour was measured. What type of variable is this?

Circle your answer.

dependent **independent** **controlled** [1]

- (g) In this investigation 50 cm³ of boiling water was used in step 1.

Suggest how your results would change if **150 cm³** of boiling water was used.

Circle your answer.

shorter time for paint to start to change colour

same time for paint to start to change colour

longer time for paint to start to change colour

[1]

Examiner Only	
Marks	Remark

(h) Suggest why it was important in step 6 to place the rods in cold water for five minutes.

_____ [1]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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