Rewarding Learning

General Certificate of Secondary Education

Centre Number

Candidate Number

Single Award Science

Unit 4

Booklet B

Higher Tier

[GSA44]

GSA44

Assessment

Assessment Level of Control:
Tick the relevant box (✓)

Controlled Conditions	
Other	

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all** questions.

INFORMATION FOR CANDIDATES

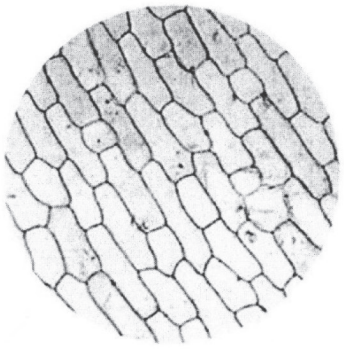
The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **10(b)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

12646

32GSA4401

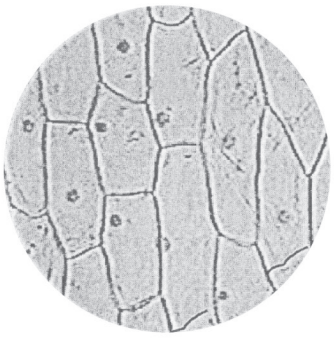
Section A – Biology

1 **(a)** The photographs below show onion cells seen under a microscope at different magnifications.



A

B



C

Source: Chief Examiner

(i) Which photograph (**A**, **B** or **C**) shows the cells under the lowest magnification?

_____ [1]

(ii) Why is it good practice to focus using a low magnification first and then increase to a higher magnification?

_____

_____ [1]

(iii) Count the number of **complete** cells shown in photograph **C**.

_____ [1]

(b) A student wants to prepare a microscope slide of cheek cells. He uses the method below.

A Gently scrape the inside of your cheek.
B Smear the cells onto the centre of a microscope slide.
C Add a drop of methylene blue to stain the cells.
D Carefully put a coverslip on top of the cells.

(i) Suggest why the cells need to be stained in step **C**.

_____

_____ [1]

(ii) Why is a coverslip put on top of the cells in step **D**?

_____

_____ [1]

2 Three students are planning an investigation to compare their pulse rates after exercise. The students describe what exercise they will do as shown below.

Their teacher explained that if they carry out the investigation in this way it will not be a fair test.

(a) Explain fully why their investigation will **not** be a fair (valid) test.

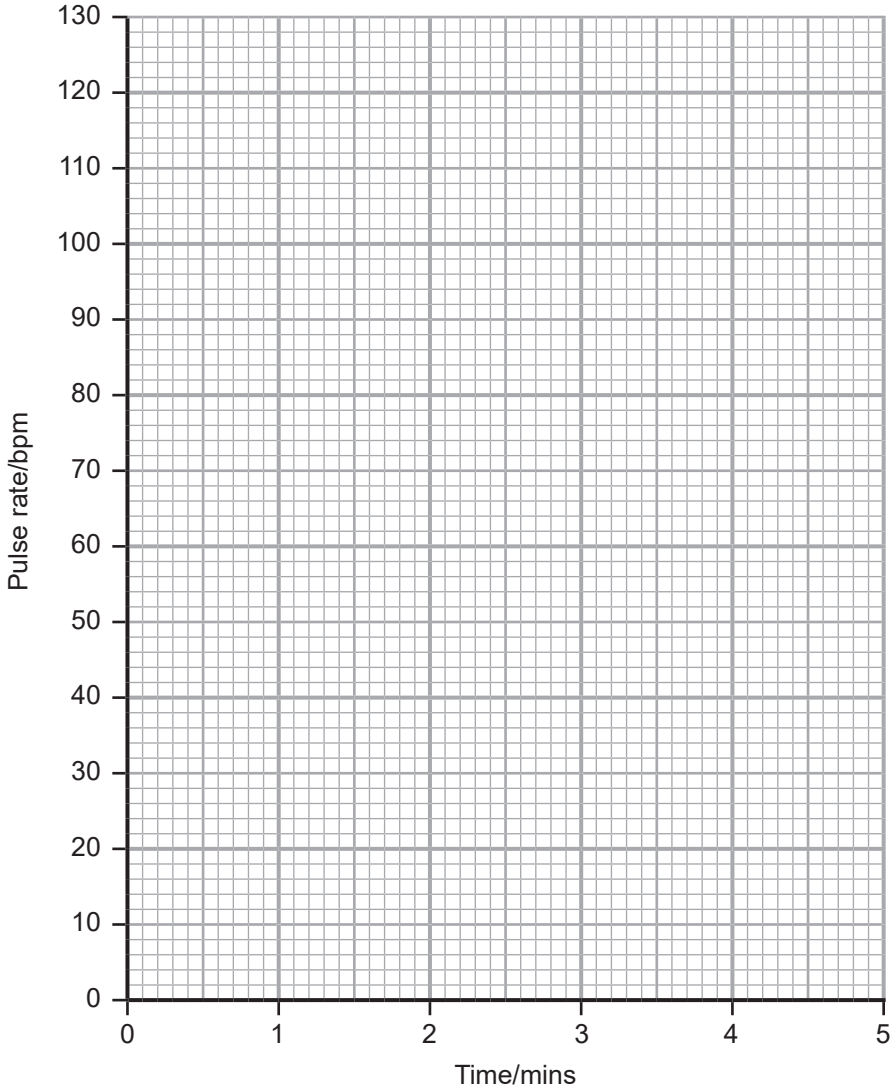
_____

_____ [2]

(b) Another student exercised and recorded her pulse rate every minute during exercise. The table below shows her results.

Time/mins	Pulse rate/bpm
0	70
1	78
2	88
3	100
4	115
5	130

(i) Use the grid below to plot and draw a line graph of these results.



[3]

(ii) Describe the trend shown by these results.

_____

_____ [1]

[Turn over

3 A student wants to find out if starch is produced during photosynthesis in plants. He tests a leaf for the presence of starch using the method below.

1. Boil the leaf in water.
2. Remove the leaf from the boiling water and place it in a test tube of ethanol.
3. Heat the test tube of ethanol.
4. Remove the leaf and rinse it with water.
5. Place the leaf on a white tile and add reagent **X** to test for starch.

(a) Why is the leaf boiled in water in step **1**?

_____

_____ [1]

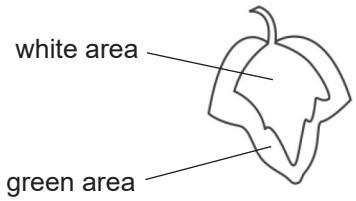
(b) How would the student safely heat the ethanol in step **3**?

_____ [1]

(c) Name the reagent **X** that is used to test for starch in step **5**.

_____ [1]

(d) The diagram below shows a leaf from a variegated plant.



The leaf is taken from a plant that had been in light for 24 hours.

(i) On the diagram below shade the area of the leaf that **will** contain starch after 24 hours.

[1]

(ii) What was being tested by using a variegated leaf in this investigation?

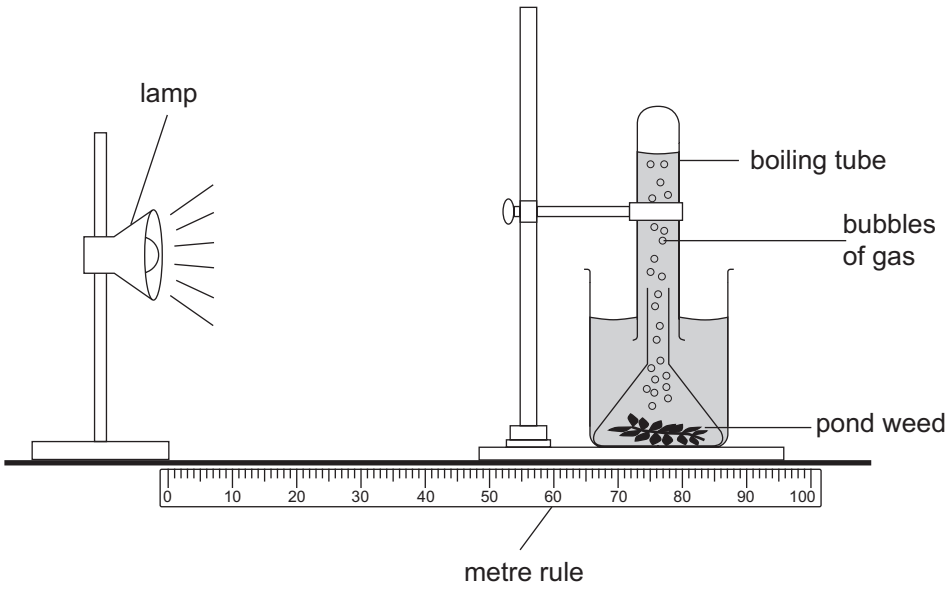
Place a tick (✓) beside the most suitable statement.

Statement	**Tick (✓)**
chlorophyll is required for photosynthesis	
light is required for photosynthesis	
carbon dioxide is required for photosynthesis	

[1]

[Turn over

(e) The diagram below shows how a student investigated the effect of light intensity on the rate of photosynthesis.



(i) Using this apparatus, suggest how the student could **increase** the intensity of light.

_____ [1]

(ii) To measure the rate of photosynthesis, the student counted the number of bubbles of gas produced in 1 minute. Suggest **one** reason why this method would **not** give accurate results and describe how this method could be improved.

_____

_____

_____ [2]

(iii) Name the gas produced during photosynthesis.

_____ [1]

(f) The student continued his investigation by carrying out experiments to find which factor had the greatest effect on the rate of photosynthesis. The table below shows his results.

Factor tested			
Temperature/°C	**Light intensity/ arbitrary units**	**Carbon dioxide concentration/ %**	**Rate of photosynthesis/ arbitrary units**
20	3	0.03	75
20	6	0.03	75
20	3	0.06	150
20	6	0.06	195
30	3	0.03	75
30	6	0.03	75
30	3	0.06	180
30	6	0.06	270

(i) Which set of conditions gives the **highest** rate of photosynthesis?

_____

_____ [1]

(ii) What effect on photosynthesis, if any, does temperature have when there is 0.03% of carbon dioxide present?

_____

_____ [1]

(iii) Which factor has the **greatest** effect on the rate of photosynthesis?

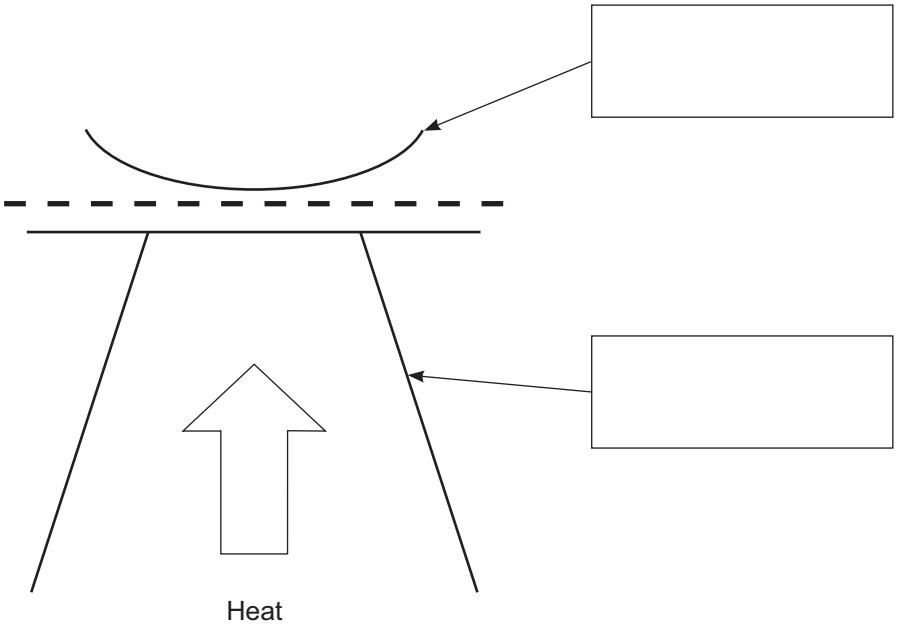
_____ [1]

[Turn over

Section B – Chemistry

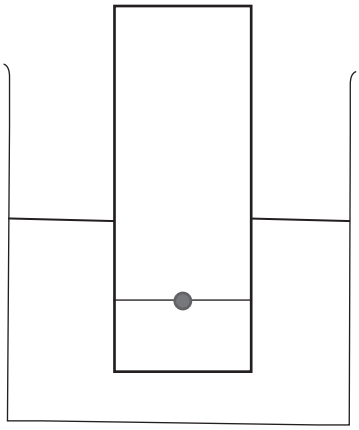
4 Students can use different methods to separate different mixtures.

(a) Evaporation can be used to separate a mixture of salt and water as shown below.
Complete the diagram by adding the names of the two pieces of apparatus.



[2]

(b) Another method of separation is chromatography. This is used to separate colours in ink. The diagram below shows a chromatography experiment that has **not** been set up correctly.

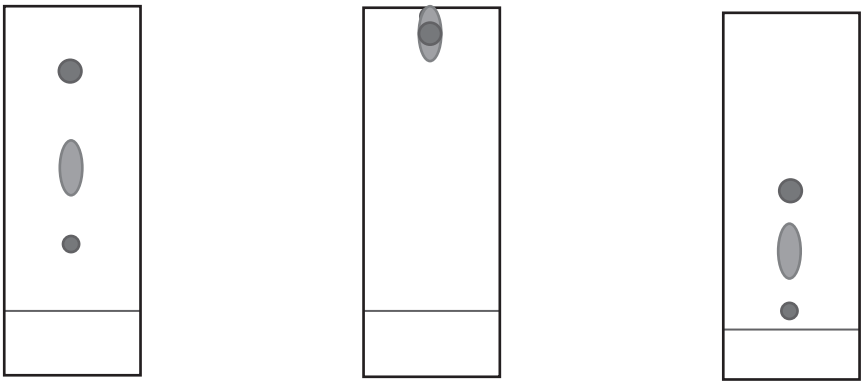


(i) What has been done incorrectly in this set-up?

_____

_____ [1]

Another student accidentally left his chromatography experiment for 24 hours.



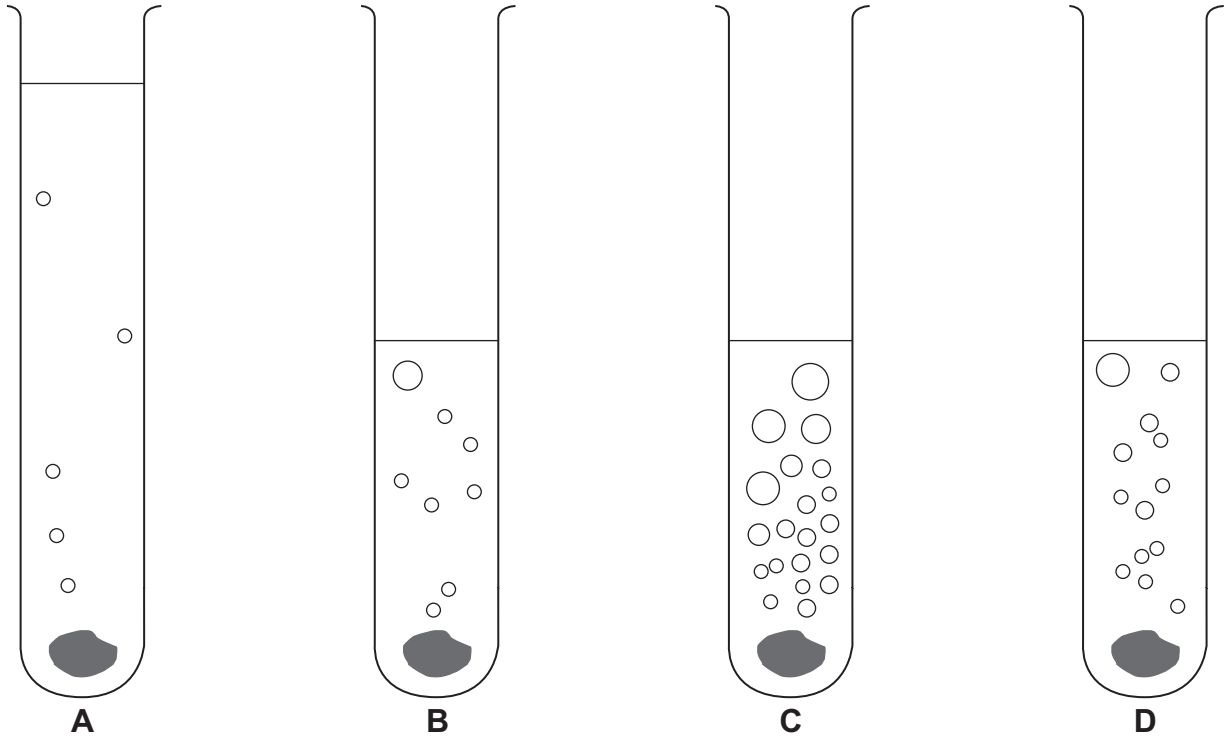
A **B** **C**

(ii) Which chromatogram (**A**, **B** or **C**) would he expect to get after 24 hours?

_____ [1]

[Turn over

5 A student investigated the reactivity of four metals (**A**, **B**, **C** and **D**) by adding them to acid as shown below. The order of reactivity was worked out by counting the number of bubbles produced in 1 minute.



(a) Using information shown in the diagram, put the metals **A**, **B**, **C** and **D** in order of reactivity. Put the most reactive first.

_____ _____ _____ _____ [2]

(b) Describe one thing shown in the diagram that means this investigation is **not** a fair (valid) test.

_____

_____ [1]

(c) Name the gas produced during these reactions.

_____ [1]

(d) The student repeated the investigation and recorded the starting and finishing temperatures of each reaction. His results are shown below.

Metal	Starting temperature/°C	Finishing temperature/°C	Change in temperature/°C
A	21	27	6
B	24	42	18
C	22		62
D	21	50	29

(i) Why is it **not** important that the starting temperature is the same for each reaction?

_____

_____ [1]

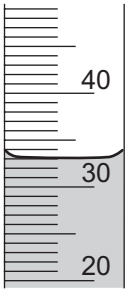
(ii) Calculate the finishing temperature for metal **C**.

_____ °C [1]

(iii) Which type of graph would be best to display this data?

_____ [1]

6 **(a)** A student is planning an investigation and needs to measure the volume of acid using a measuring cylinder.

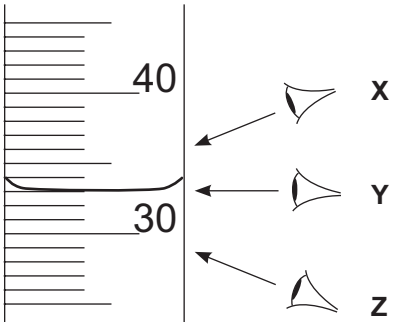


Source: © Giphotostock / Science Photo Library

(i) What volume of acid is shown in the measuring cylinder above?

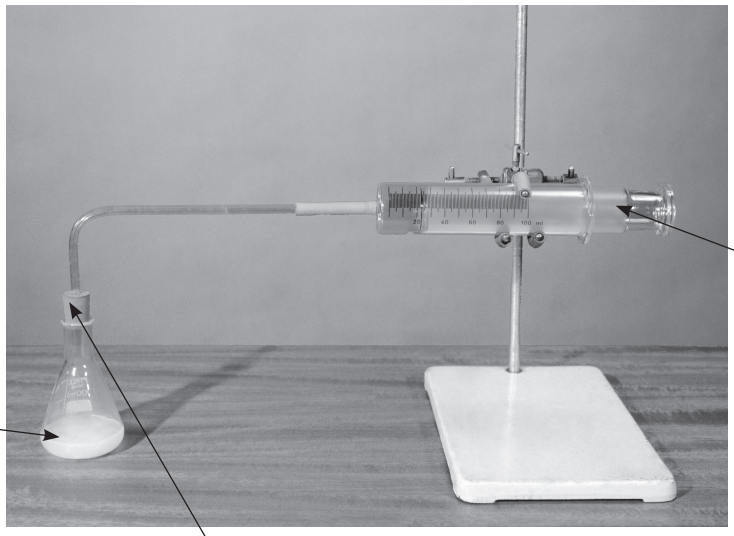
_____ cm^3 [1]

(ii) When the student is reading the value on the measuring cylinder, from which position (**X**, **Y** or **Z**) should she take the reading?



_____ [1]

The rate of reaction between copper carbonate and sulfuric acid was investigated using the apparatus shown below.



Source: © Andrew Lambert Photography / Science Photo Library

The student used the following method:

1. Measure 100 cm^3 of sulfuric acid and pour it into the conical flask.
2. Add 0.25 g of copper carbonate to the conical flask.
3. Insert the bung.
4. Record the volume of gas produced every 20 s.
5. Repeat steps 1–4 using a different concentration of acid.

(b) Suggest the hypothesis being tested in this investigation.

_____

_____ [1]

[Turn over

(c) The student recorded the following results.

Reaction	Concentration of acid/ mol dm^{-3}	Volume of gas produced/cm^3					
		0 s	20 s	40 s	60 s	80 s	100 s
A	0.5	0	14	24	35	41	45
B	1.0	0	18	30	37	42	48
C	1.5	0	20	32	41	45	48
D	2.0	0	22	35	45	48	48
E	2.5	0	24	39	48	48	48

(i) State the range of concentration of acid that the student used.

_____ mol dm^{-3} [1]

(ii) Which reaction (**A**, **B**, **C**, **D** or **E**) had **not** finished after 100 s?
Use information from the table to explain your answer.

_____

_____ [2]

(iii) The student wants to get a more accurate value for the finishing time for reaction **E**. She carries out the experiment again. How should she record the volume of gas produced?

Circle your answer.

record the volume at 40 s and 60 s

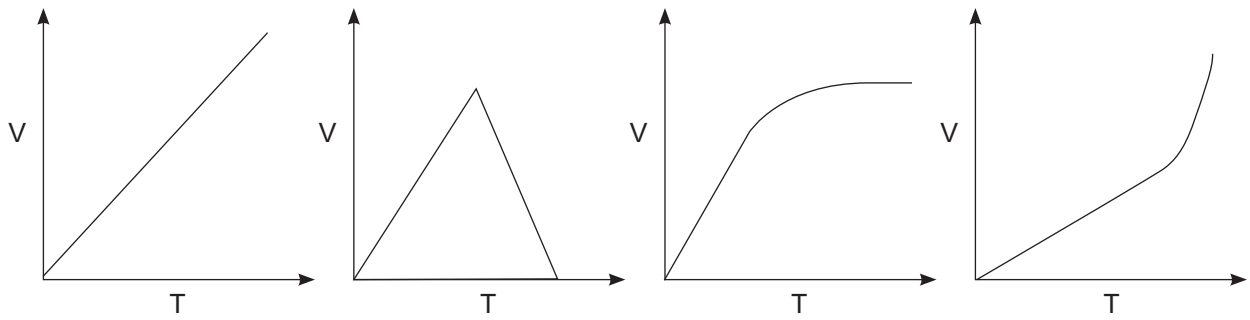
record the volume at 0 s, 20 s, 40 s, 60 s, 80 s and 100 s

record the volume between 40 s and 60 s in 5 s intervals

record the volume between 40 s and 60 s in 2 s intervals

[1]

(iv) The student plotted a line graph of volume (V) against time (T) for reaction **D**. Which of the following graphs (**1**, **2**, **3** or **4**) shows the shape she should expect?

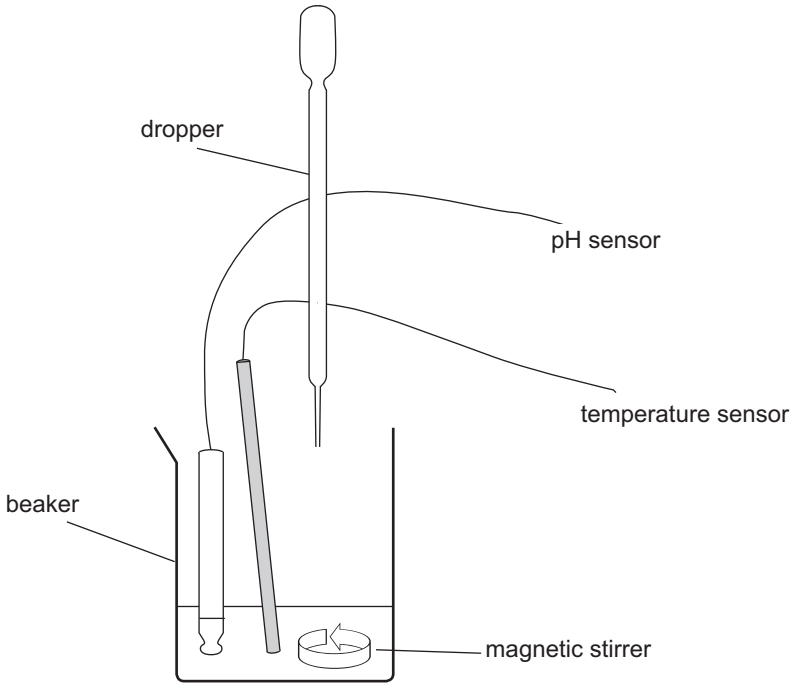


1 **2** **3** **4**

_____ [1]

7 A student noticed that when an acid and an alkali were mixed together, the temperature increased. He thought it may be because the pH changed as they reacted.

To investigate this, he used the following apparatus with equal concentrations of a strong acid and a strong alkali.



(a) Why does using the magnetic stirrer improve the accuracy of the results?

_____

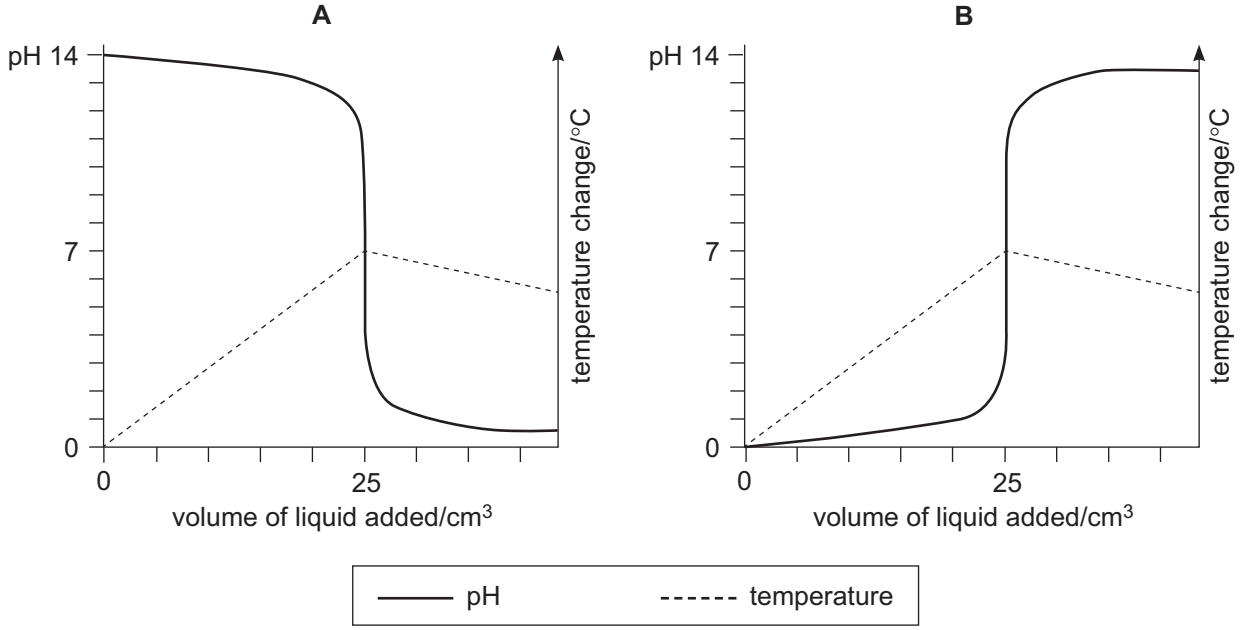
_____ [1]

(b) The student's hypothesis was:

'The temperature will increase as the pH increases.'

To test this he did two experiments. In one he added alkali to acid and in the other he added acid to alkali. In each experiment he started with 25 cm^3 of one liquid in a beaker and added 45 cm^3 of the other liquid, 5 cm^3 at a time. After each addition he measured the increase in temperature and the pH of the mixture.

He plotted graphs of his results. These are shown below.



(i) Which graph (**A** or **B**) shows the results for the acid being added to the alkali? Explain your answer.

_____

_____ [1]

(ii) Using evidence from the graphs, explain why the student's hypothesis was **incorrect**.

_____

_____ [1]

(iii) State fully the trend shown in **temperature change** by graph **A**.

_____

_____ [2]

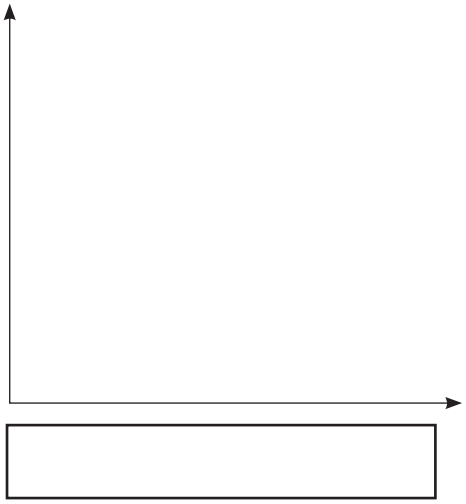
[Turn over

Section C – Physics

8 A student carried out an investigation to show how the resistance of a metal wire depends on its length. The results are shown below.

Length/m	Resistance/Ω			Average resistance /Ω
	Try 1	Try 2	Try 3	
0.1	2.3	2.4	2.3	2.3
0.3	4.5	4.4	4.3	4.4
0.5	6.9	6.8	6.8	
0.7	9.3	4.2	9.5	9.4
0.9	11.2	11.4	11.3	11.3

(a) The student wants to plot a graph of her results. In the box, on the diagram, below add the label for the x-axis.



[1]

(b) What **interval size** was used for the length of the wire in this investigation?

_____ m [1]

(c) The student thought one of the results was an anomaly.

(i) Circle the anomalous result in the table opposite. [1]

(ii) Look at the student's table of results and state how she dealt with the anomalous result.

_____

_____ [1]

(iii) Calculate the average resistance for the wire with a length of 0.5 m.
Give your answer to **one** decimal place.

(Show your working out.)

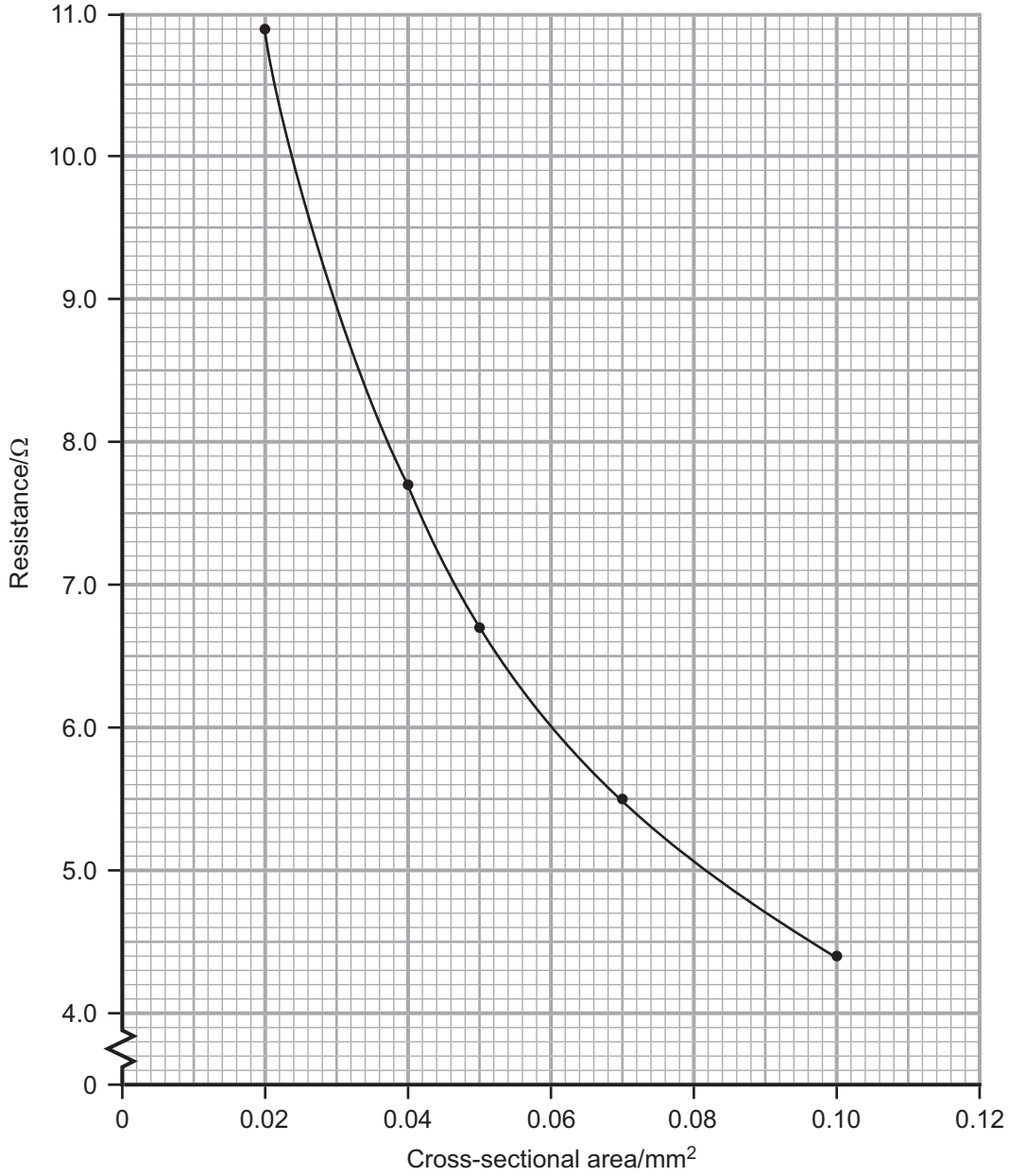
_____ Ω [3]

(d) Why did the student carry out the investigation three times for each length of wire?

_____

_____ [1]

(e) The graph below shows how the cross-sectional area of a piece of wire affects its resistance.



(i) Describe the trend shown by this data.

_____

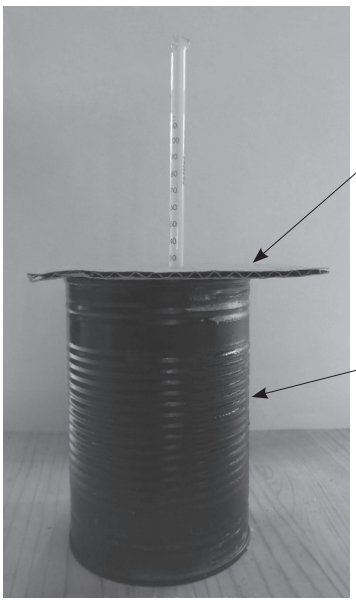
_____ [1]

(ii) Predict the resistance of a wire with a cross-sectional area of $0.12\,mm^2$.

_____ Ω [1]

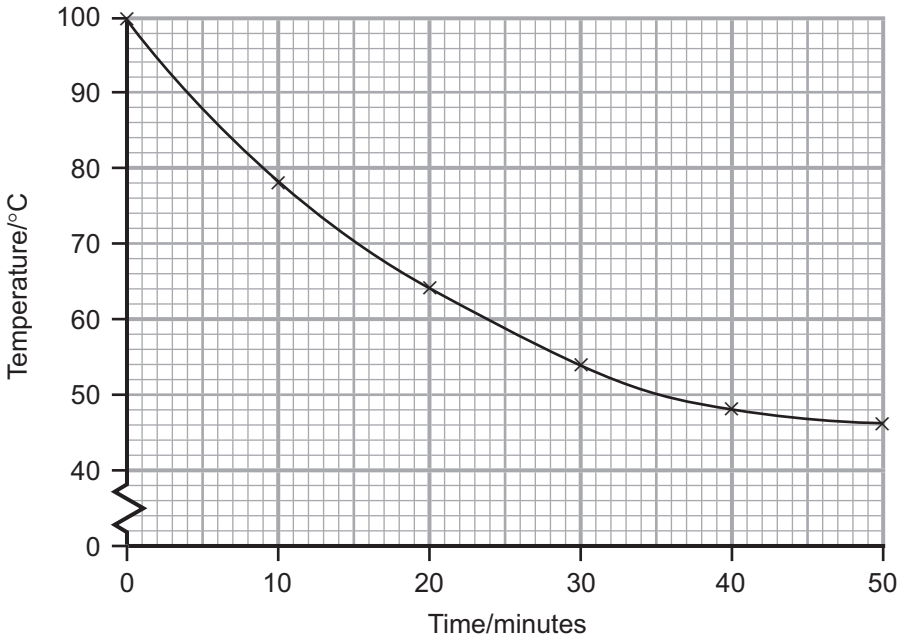
[Turn over

9 A scientist tests a metal can, that has a dark matt surface, to see how quickly heat escapes from it. She fills the can with boiling water and records the temperature every 10 minutes.



Source: Principal Examiner

The graph below shows the results she obtained.



(a) In which **10 minute period** is the water losing heat most slowly?

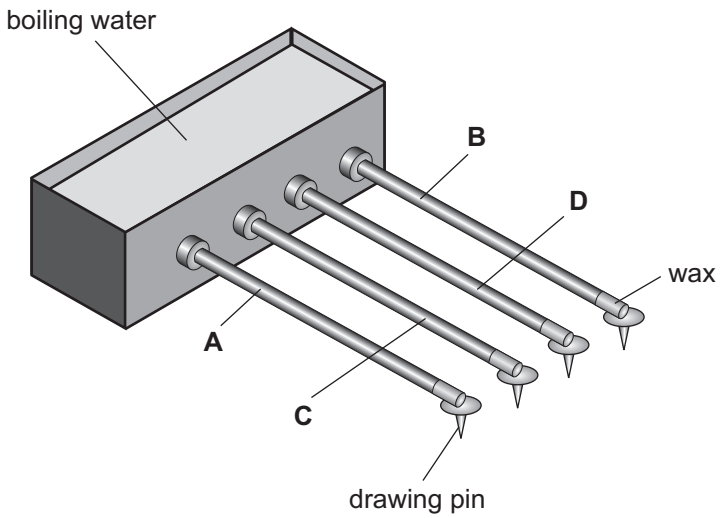
_____ to _____ minutes [1]

BLANK PAGE

DO NOT WRITE ON THIS PAGE

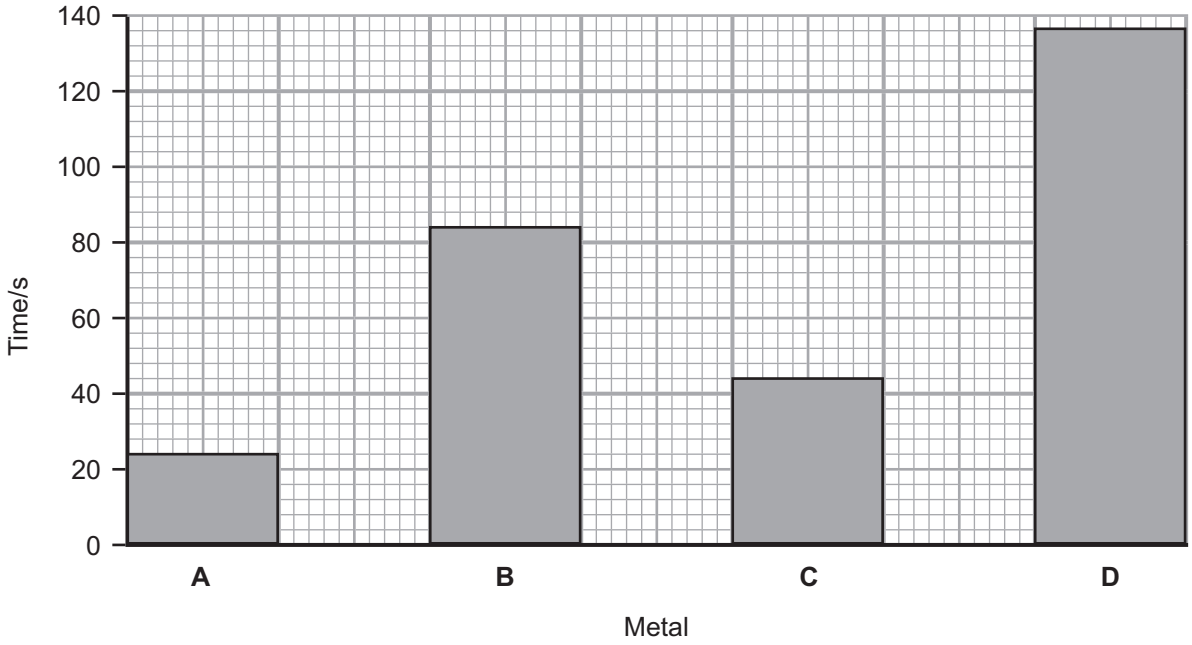
(Questions continue overleaf)

(b) A student set up the apparatus below to show which metal was the best conductor of heat.



The student timed how long it took for the wax to melt and each drawing pin to drop.

The bar graph below shows the results he obtained.



(i) Which metal (**A**, **B**, **C** or **D**) was the best conductor of heat?

_____ [1]

(ii) Use the graph opposite to state the range of times recorded.

_____ s [1]

(iii) Complete the sentence below.

If a glass rod had been used instead of a metal rod, it would take

_____ time for the wax to melt and the drawing pin to drop. [1]

10 **(a)** Ohm's law states:

'The current through a wire is directly proportional to the voltage across the wire, provided the temperature remains constant.'

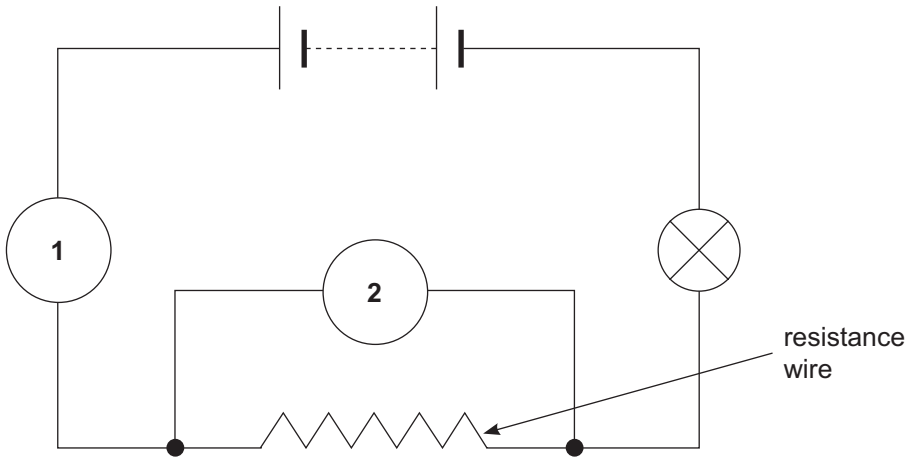
(i) Name the independent variable in this statement of Ohm's law.

_____ [1]

(ii) Name the controlled variable in this statement of Ohm's law.

_____ [1]

The circuit below is set up to prove Ohm's Law.



(b) Describe fully how this circuit can be used to prove Ohm's law.
Your answer should include:

- the names of the meters labelled **1** and **2** and how they are connected in the circuit;
- a description of the method; and
- how a graph of the results would prove Ohm's law.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

[Turn over

(c) The results from this investigation can be used to calculate the resistance of the wire. What formula is used to calculate resistance?

Circle your answer.

$$\textbf{resistance} = \frac{\textbf{voltage}}{\textbf{current}}$$

$$\textbf{resistance} = \textbf{voltage} \times \textbf{current}$$

$$\textbf{resistance} = \frac{\textbf{current}}{\textbf{voltage}}$$

[1]

THIS IS THE END OF THE QUESTION PAPER

DO NOT WRITE ON THIS PAGE

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

Examiner Number

Permission to reproduce all copyright material has been applied for.
In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA will be happy to rectify any omissions of acknowledgement in future if notified.