



Rewarding Learning

General Certificate of Secondary Education
2019

Centre Number

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Candidate Number

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Single Award Science

Unit 4

Booklet B

Higher Tier

[GSA44]

GSA44

TUESDAY 28 MAY 2019, AFTERNOON

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 **3(a)(i)**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

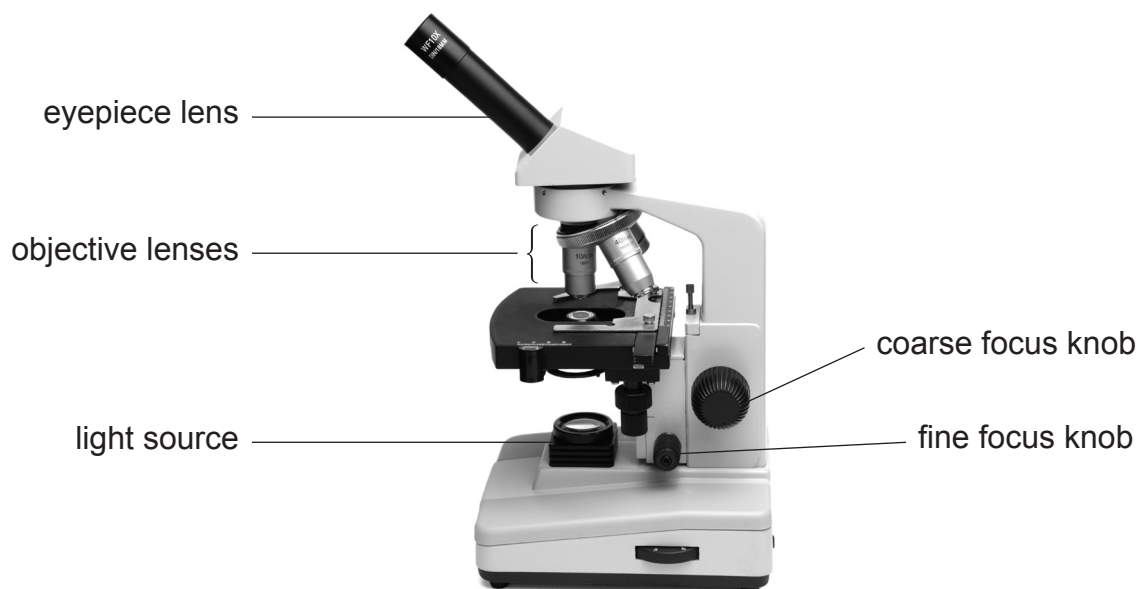
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28GSA4401

Section A – Biology

- 1 (a) The diagram below shows a microscope that can be used to look at onion cells.



© Martin Shields / Science Photo Library

- (i) The eyepiece lens has the label '×10'. What does ×10 mean?

_____ [1]

- (ii) When viewing the onion cells for the first time it is useful to see as many cells as possible. Which objective lens will allow you to see the most cells?

Choose from:

×4

×10

×40

_____ [1]

- (b) When making a slide of onion cells a thin layer of onion skin should be used.

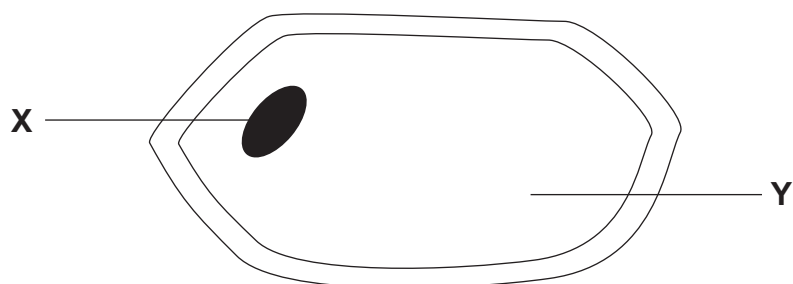
- (i) Suggest **two** reasons why it is important that the layer is thin.

1. _____

2. _____ [2]



The diagram below shows the sketch of one onion cell as viewed under a microscope.



(ii) Name the parts labelled **X** and **Y**.

Choose from:

cytoplasm : **chloroplast** : **nucleus**

cell wall : **cell membrane** : **vacuole**

X _____

Y _____ [2]

[Turn over



2 (a) Paul tested a sample of food and found it contained both protein and sugar.

(i) Complete the table below.

[2]

Food type	Reagent	Initial colour	Final colour
protein		blue	
sugar	Benedict's	blue	brick red

(ii) Paul then tested a different sample of food for sugar. How could he tell that it did **not** contain sugar?

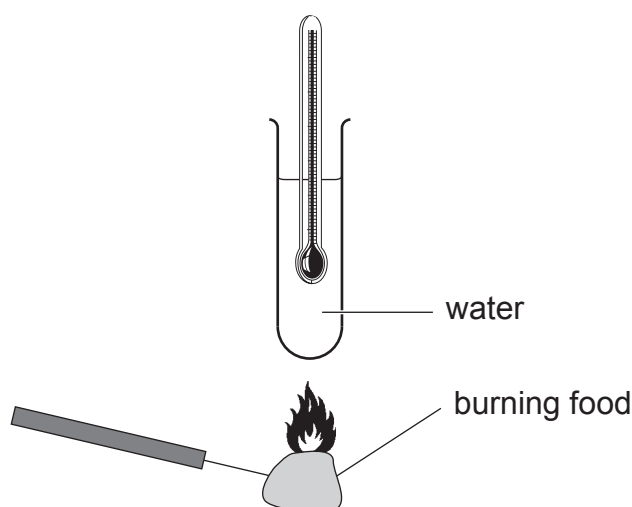
[1]

(iii) After Paul adds Benedict's reagent to the sample of food, what must be done to complete the test?

[1]



- (b) Jane investigated the energy content of a food sample using the apparatus shown below.



The temperature of the water at the start was 13°C and the final temperature was 21°C .

- (i) Calculate the temperature rise produced by this sample of food.

(Show your working out.)

_____ $^{\circ}\text{C}$ [2]

Another student repeated the investigation with a different sample of food. The starting temperature of the water was 18°C and the final temperature was 23°C .

He concluded that his piece of food contained more energy than Jane's food.

- (ii) Explain why his conclusion was **incorrect**.

_____ [1]

[Turn over]



3 (a) During photosynthesis a plant produces glucose which is stored as starch.

(i) Describe how you would show that a leaf taken from a plant contained starch.

Your answer should include:

- the steps involved in the test
- **one** reason for each step
- **one** safety precaution (apart from wearing safety goggles).

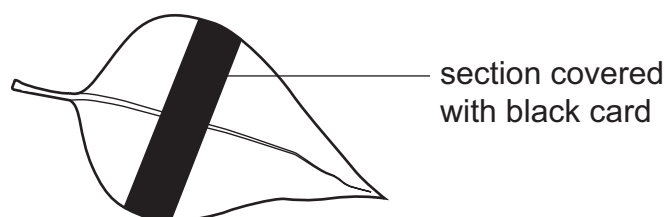
In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[illegible]

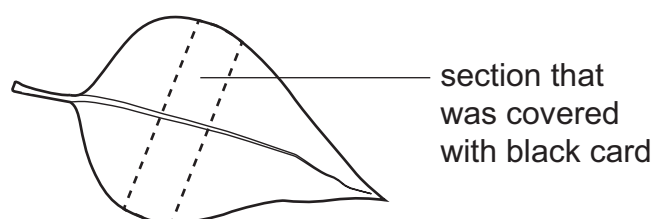
[6]



The diagram below shows a leaf which has been partially covered with black card and left in bright light.



(ii) On the diagram below shade the parts of the leaf that would contain starch.



[1]

(b) A gardener wants to investigate factors that affect the rate of photosynthesis. She thinks the amount of light the plant gets is important.

Place a tick (✓) beside the most suitable hypothesis to test this idea.

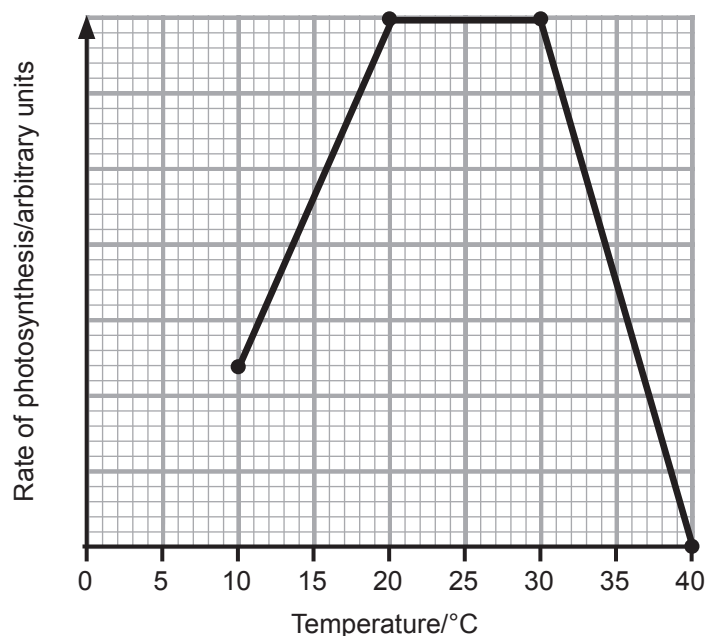
Hypothesis	Tick (✓)
if a plant gets plenty of light it will grow well	
the more light a plant gets the healthier it will be	
the more light a plant gets the more it will photosynthesise	
if a plant gets light and water it will photosynthesise	

[1]

[Turn over



- (c) Another gardener thinks the higher the temperature, the more a plant will photosynthesise. To investigate this he measured the rate of photosynthesis at different temperatures. His results are shown below.



The gardener concluded that the best temperature for photosynthesis is between 20 °C and 30 °C.

- (i) What evidence from the graph supports his conclusion?

[1]

- (ii) What should he do to get a more accurate value for the best temperature for photosynthesis?

[1]





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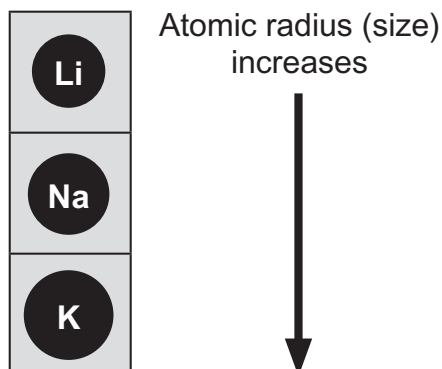
[Turn over



28GSA4409

Section B – Chemistry

- 4 (a) James studied the alkali metals (Group 1). He found that the atoms of the elements increased in size going down the group.



He suggested that because the atoms increased in size they could not move as fast and would be less reactive. To investigate this his teacher added a piece of each metal to water and timed how long it took for the metal to disappear.

- (i) Identify **one** possible risk in carrying out this investigation and suggest how to reduce the danger.

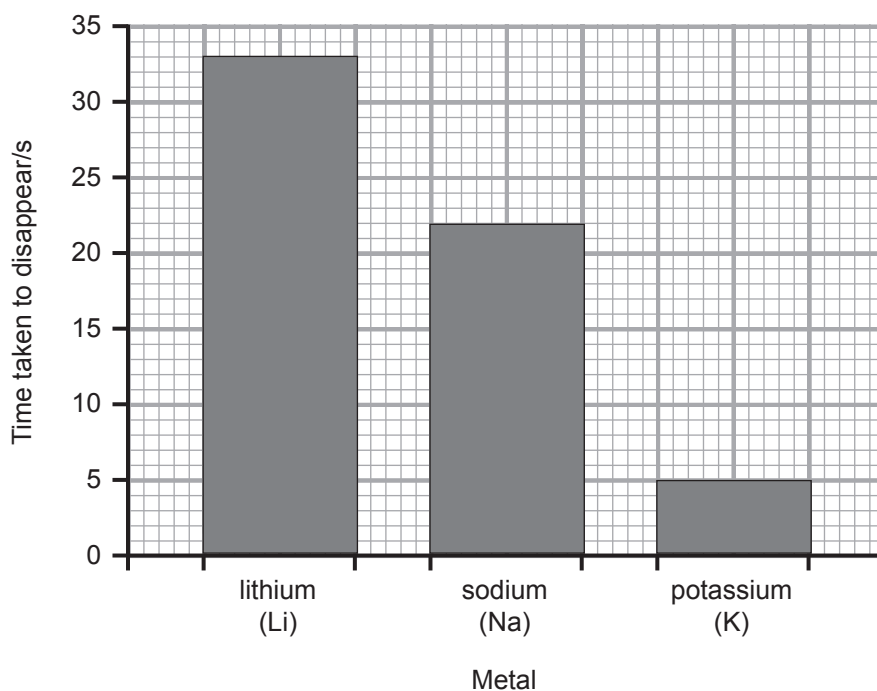
_____ [2]

- (ii) State **one** thing that had to be done to make this a fair test.

_____ [1]



The bar chart below shows the results of the investigation.



- (b) Was James correct in suggesting that the bigger atoms would be **less** reactive as you go down Group 1? Use the results in the bar chart to explain your answer.

_____ [1]

- (c) Name the gas produced in this experiment and describe the test James would carry out to identify this gas.

_____ [3]

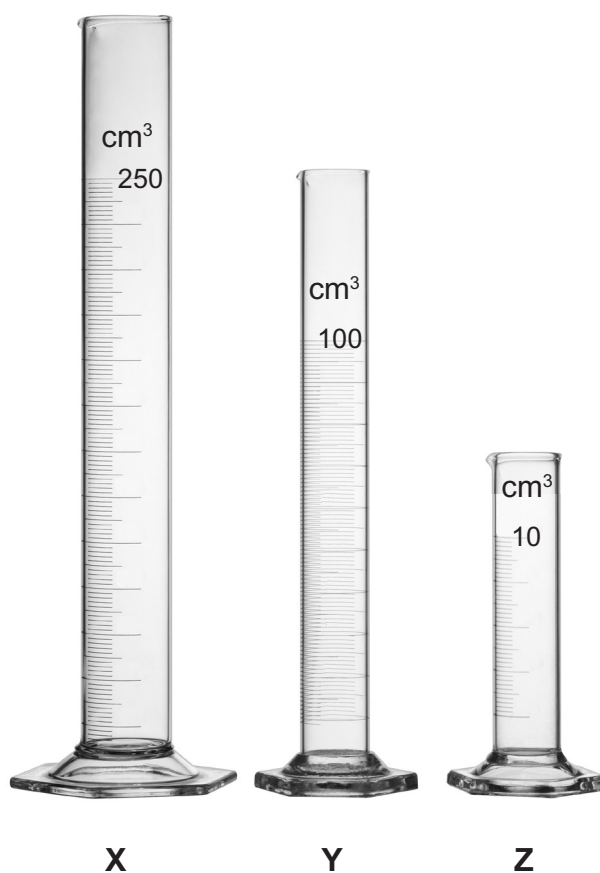
[Turn over]



- 5 Indigestion tablets are used to neutralise excess acid in the stomach. A student compared the effectiveness of four brands of tablets (**A**, **B**, **C** and **D**) by using the following method.

1. Crush the tablet.
2. Add 50 cm³ of water and stir to dissolve.
3. Add a few drops of universal indicator solution.
4. Add 5 cm³ of hydrochloric acid and stir.
5. Continue adding 5 cm³ of acid until the indicator turns green (pH7).
6. Record the volume of acid needed to neutralise the tablet.

The student used a measuring cylinder to measure the volume of acid.



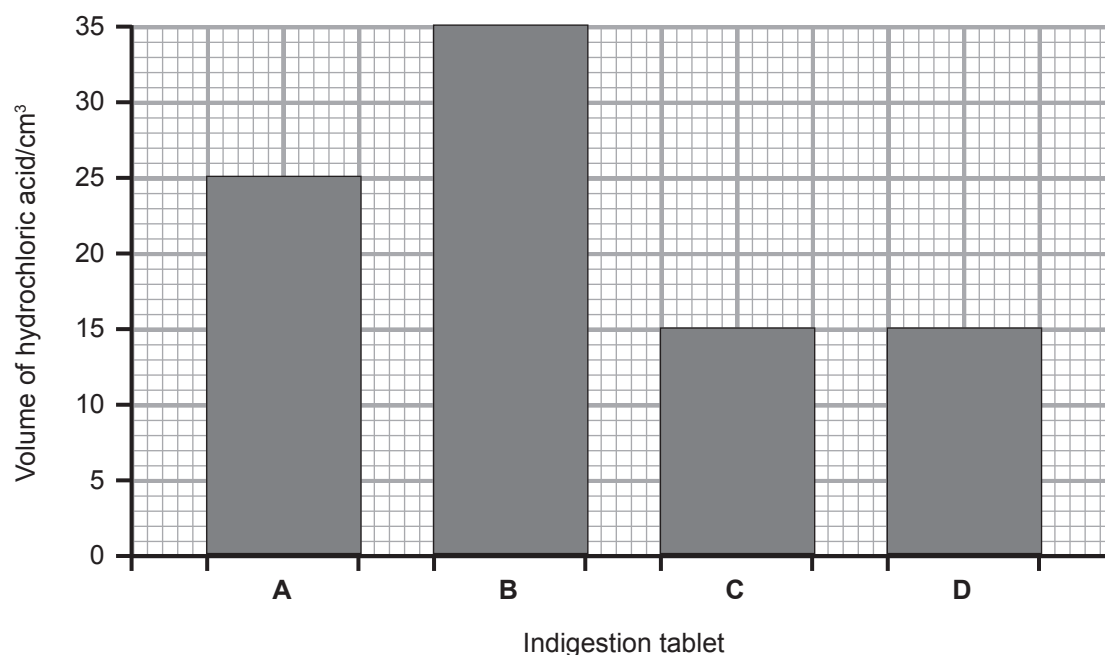
© prill / Thinkstock

- (a) Which measuring cylinder (**X**, **Y** or **Z**) would be most suitable to measure the volume of acid in steps 4 and 5? Explain your choice.

[2]



(b) The bar chart below shows the volume of acid that neutralised each tablet.



(i) State the range of the volume of hydrochloric acid used in this investigation.

_____ cm³ [1]

The student decided to change his method and retest tablets **C** and **D**.
In step 4 he added 10 cm³ of acid and then in step 5 he added 1 cm³ at a time,
until the indicator turned green.

(ii) Explain fully how this will improve his investigation.

_____ [2]

[Turn over



The diagram below gives some of the colours of universal indicator with the corresponding pH value.

yellow	light green	green	dark green	turquoise	pale blue
5	6	7	8	9	10

- (iii) Using the information above, explain why universal indicator is **not** the best method to find pH7.

_____ [1]

When the student retested tablets **C** and **D** he found that tablet **C** needed 13 cm³ of acid to neutralise it and tablet **D** needed 14 cm³.

- (iv) Using this information and the bar chart, put the tablets **A**, **B**, **C** and **D** in order of effectiveness. Put the most effective first.

_____ [2]

Sodium hydrogencarbonate is one of the chemicals in indigestion tablets.

- (c) When this reacts with acid, carbon dioxide is produced. Describe the test for carbon dioxide.

_____ [2]





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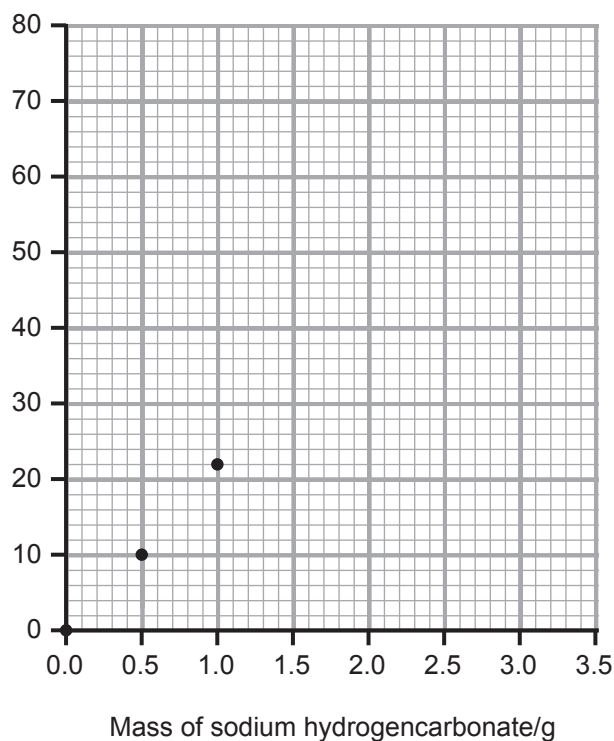


28GSA4415

- (d) The table below shows how much acid different amounts of sodium hydrogencarbonate will neutralise.

Mass of sodium hydrogencarbonate/g	Volume of acid/ cm ³
0.0	0
0.5	10
1.0	22
1.5	30
2.0	40
2.5	50
3.0	61
3.5	72

- (i) On the grid below, add a suitable label to the y-axis. [1]
- (ii) On the grid below plot and draw a line graph for these results. The first three points have been plotted for you.



(iii) State the trend shown by these results.

[1]

This graph can be represented by the equation:

$$y = mx + c$$

(iv) What is the value for **c** on this graph?

_____ cm³ [1]

(v) Did this investigation produce any anomalous results?
Explain your answer.

[1]

[Turn over]

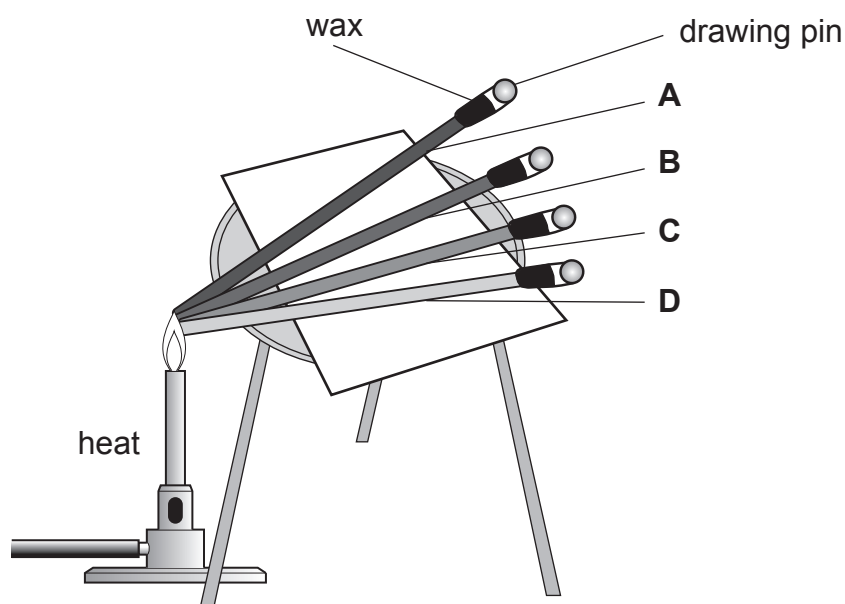
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28GSA4417

Section C – Physics

- 6 (a) A student wanted to investigate four metals to find out which was the best conductor of heat. He used the apparatus shown below.



Source: Principal Examiner

The metals were heated using a Bunsen burner and the student timed how long it took for the drawing pins to fall off.

- (i) Give **one** variable that was kept the same to make this a fair test.

_____ [1]

- (ii) What type of variable is **time** in this investigation?

Circle the correct answer.

dependent

control

independent

[1]



- (b) The investigation was carried out three times and an average calculated. The results are shown below.

Metal	Time to fall/s			
	1	2	3	Average
A	5.7	5.9	5.8	5.8
B	8.2	8.3	8.0	
C	14.9	14.1	14.5	14.5
D	10.7	20.1	10.5	10.6

- (i) Why did the student carry out the investigation three times for each metal?

_____ [1]

- (ii) Calculate the average time for metal **B**, giving your answer to **one** decimal place.

(Show your working out.)

_____ s [3]

- (iii) The student thought **one** of the times recorded was an anomaly. Circle the anomalous result in the table above.

[1]

- (iv) Look at the student's table of results and state how he dealt with the anomalous result.

_____ [1]

[Turn over]



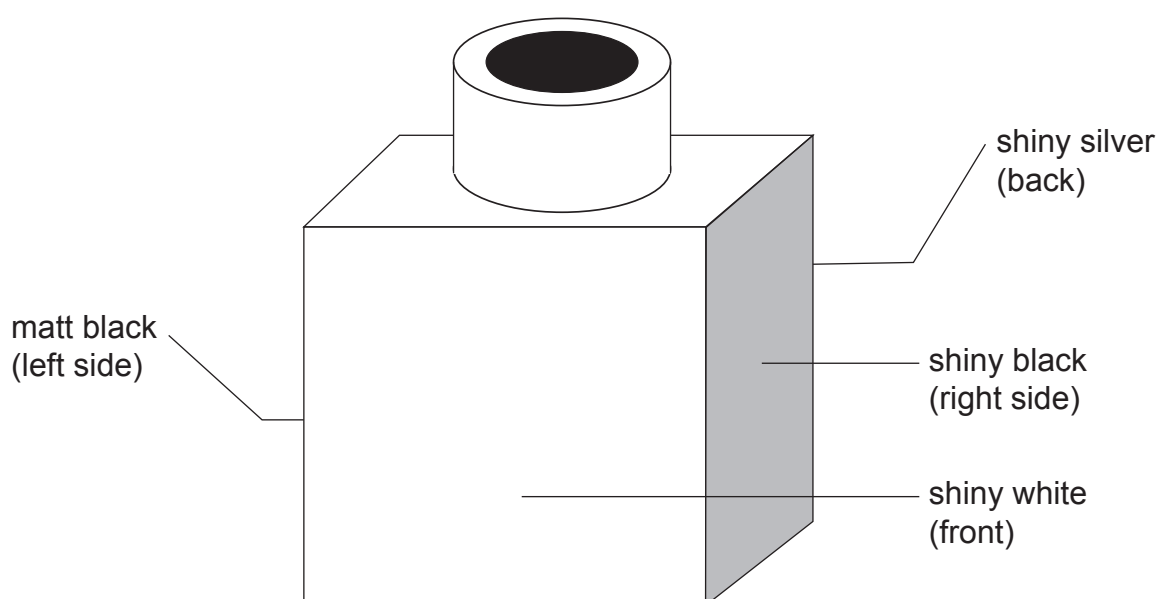
- (v) Of the metals tested, copper was the best conductor.
Suggest which metal (**A**, **B**, **C** or **D**) was copper.

_____ [1]

- (vi) Which **type** of graph would be best to display this data?

_____ [1]

- (c) Shown below is a Leslie's cube. When filled with boiling water it can be used to demonstrate the effect of colour on the radiation of heat. It has four sides made from the same metal but with different coloured surfaces.



One student suggested they could measure the heat radiated from a surface by **touching** each side of the cube.

- (i) Apart from the danger of injury, explain why this will **not** indicate the amount of heat radiated.

_____ [1]



Another student suggested putting his hand 5 cm from each side in turn and feeling which radiated the most heat.
His teacher said it would be more accurate if he used a heat sensor instead of his hand.
The results from the heat sensor are shown below.

Surface colour	Temperature/°C
Shiny white	49.8
Shiny silver	27.3
Shiny black	68.3
Matt black	68.8

- (ii) Use these results to explain fully why the student placing his hand 5 cm from the cube would **not** be an accurate way of finding the best radiator of heat.

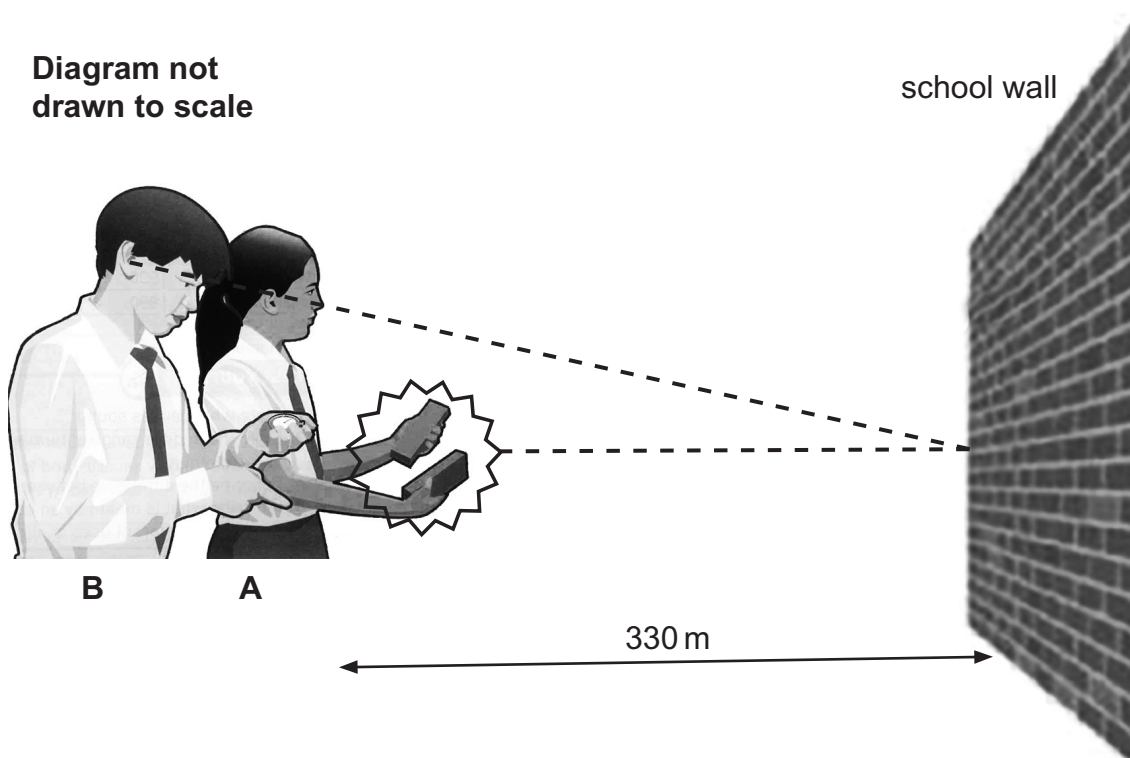
[2]

[Turn over



- 7 The diagram below shows two students **A** and **B** experimenting to find the speed of sound using the echo method.

Diagram not
drawn to scale



Source: CCEA

The return time for the echo is measured by student **B**.

(a) When should he:

(i) start the stopwatch?

_____ [1]

(ii) stop the stopwatch?

_____ [1]



- (b) Slow reactions are a possible source of error in this experiment.
Student **B** takes 0.1 s to react when starting the stopwatch and 0.1 s when stopping the stopwatch.

What effect, if any, will this have on the time he measured for the echo to return?

Choose from:

no effect : **longer time** : **shorter time**

[1]

- (c) Which formula will be used to calculate the speed of sound?

Circle the correct answer.

speed = distance × time : **speed = $\frac{\text{time}}{\text{distance}}$** : **speed = $\frac{\text{distance}}{\text{time}}$**

[1]

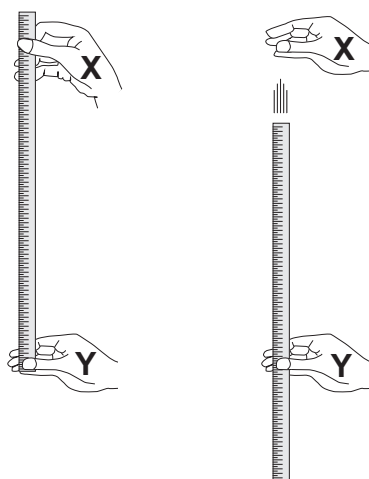
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28GSA4423

- 8 The diagram below shows two students **X** and **Y** using a ruler to test their reactions.

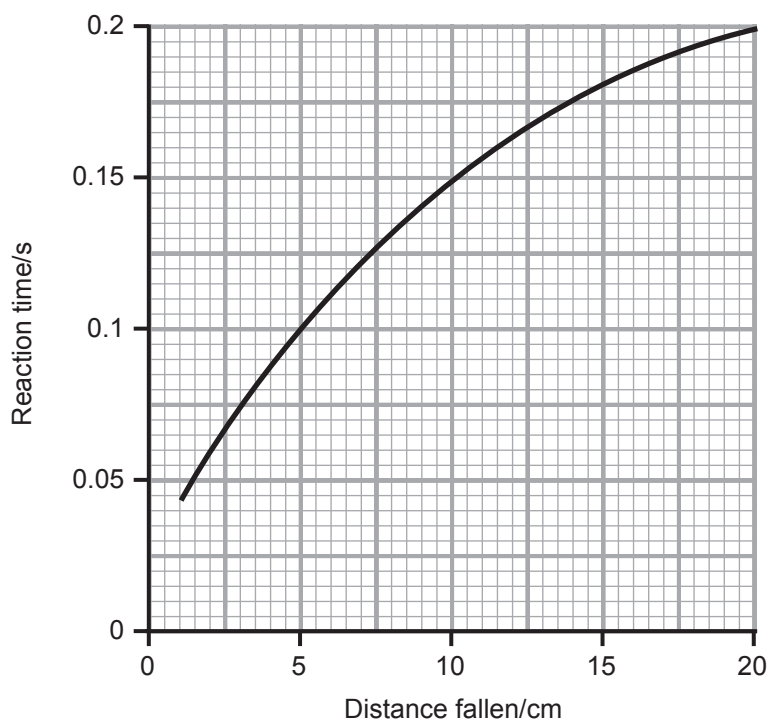


Source: Principal Examiner

- (a) The reactions of which student (**X** or **Y**) are being tested?
Explain your answer.

[1]

The graph below shows the relationship between the distance fallen by the ruler and reaction times.



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28GSA4424

(b) Student **X** caught the ruler at a distance of 5 cm and student **Y** at 10 cm.

(i) Use the graph to compare the reaction times of student **X** and student **Y**.

[2]

Each student was a different gender, **X** was a girl and **Y** was a boy.

(ii) Why is it **not** possible to conclude from this investigation that girls have faster reactions than boys?

[1]

(iii) Describe fully how this investigation needs to be changed to be able to conclude if reaction time depends on gender.

[2]

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Question Number	Marks
1	
2	
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8	

Total Marks	
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Examiner Number

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SYMBOLS OF SELECTED IONS

Positive ions

Name	Symbol
Ammonium	NH_4^+
Chromium(III)	Cr^{3+}
Copper(II)	Cu^{2+}
Iron(II)	Fe^{2+}
Iron(III)	Fe^{3+}
Lead(II)	Pb^{2+}
Silver	Ag^+
Zinc	Zn^{2+}

Negative ions

Name	Symbol
Butanoate	$\text{C}_3\text{H}_7\text{COO}^-$
Carbonate	CO_3^{2-}
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogencarbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	HCOO^-
Nitrate	NO_3^-
Propanoate	$\text{C}_2\text{H}_5\text{COO}^-$
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

Data Leaflet

Including the Periodic Table of the Elements

For the use of candidates taking
Science: Chemistry,
Science: Double Award
or Science: Single Award

Copies must be free from notes or additions of any
kind. No other type of data booklet or information
sheet is authorised for use in the examinations

SOLUBILITY IN COLD WATER OF COMMON SALTS, HYDROXIDES AND OXIDES

Soluble
All sodium, potassium and ammonium salts
All nitrates
Most chlorides, bromides and iodides EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble
Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

gcse examinations chemistry

Group

1	H	Hydrogen	1
---	---	----------	---

† 90 – 103 Actinium series

$$\begin{array}{c} \mathbf{a} \\ \mathbf{X} \\ \mathbf{b} \end{array}$$

x = atomic symbol

b = atomic number

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	145 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	242 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	245 Bk Berkelium 97	251 Cf Californium 98	254 Es Einsteinium 99	253 Fm Fermium 100	256 Md Mendelevium 101	254 No Nobelium 102	257 Lr Lawrencium 103