



Rewarding Learning

General Certificate of Secondary Education
2025

Centre Number

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Candidate Number

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Single Award Science

Unit 4

Booklet B



Foundation Tier

[GSA42]

GSA42

MONDAY 9 JUNE, MORNING

TIME

1 hour.

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 and use a dark HB pencil for drawings and graphs.

Do not write with a gel pen.

Answer **all ten** 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.

You may use a scientific calculator.

Quality of written communication will be assessed in Question 3.

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

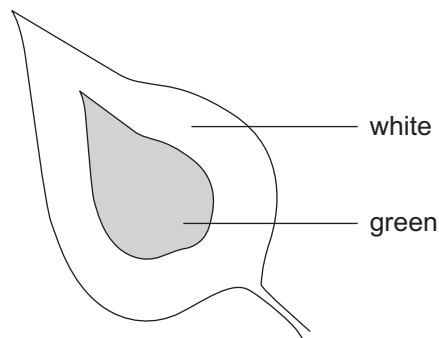
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32GSA4201

Section A – Biology

- 1 The diagram below shows a variegated leaf (a leaf which has a white part and a green part).



- (a) Name the chemical that gives the green part of this leaf its colour.

Choose from:

chlorophyll

nucleus

cytoplasm

[1]

This leaf was taken from a plant which had been left in bright light for 48 hours.

- (b) Complete the following sentence.

Choose from:

cold

dark

starch

colour

Before the plant was left in bright light, it was placed in a

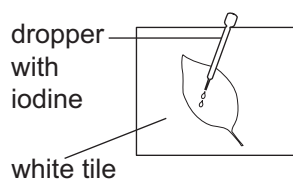
_____ cupboard for 48 hours to remove all the

_____ from the leaf.

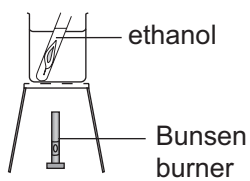
[2]



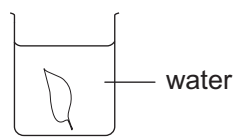
The diagrams below show the steps used to test this leaf for starch.
They are **not** in the correct order.



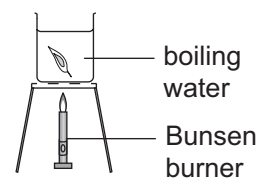
1



2



3



4

(c) Use the numbers **1**, **2**, **3** and **4** to put these steps in the correct order.

_____ [2]

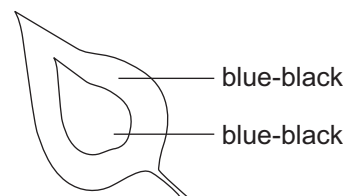
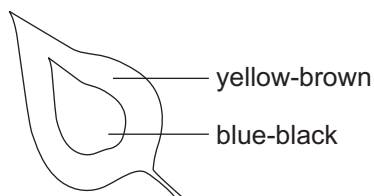
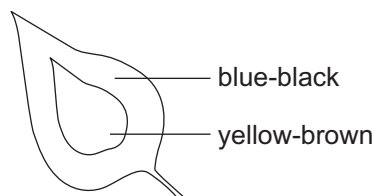
(d) Complete the table below about some of the risks involved in this experiment.

What is the risk?	What could happen?	How can we prevent this from happening?
ethanol is flammable	ethanol could catch fire	
iodine is a stain	iodine could stain your hands	

[2]

(e) Which diagram below shows the result you would expect to see when iodine is used to test this variegated leaf for starch?

Circle your answer.

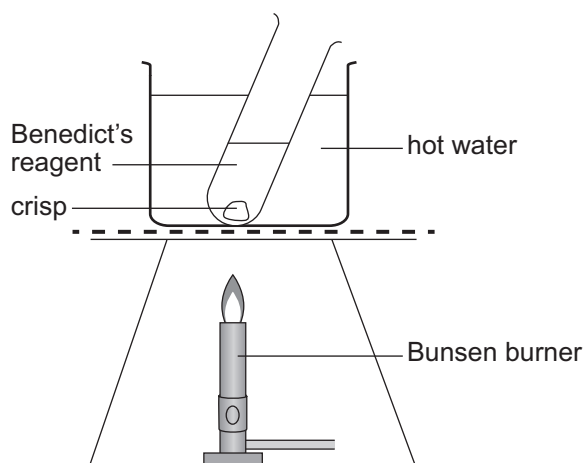


[1]

[Turn over]



- 2 (a) A student carried out a food test on a crisp using the apparatus shown below.



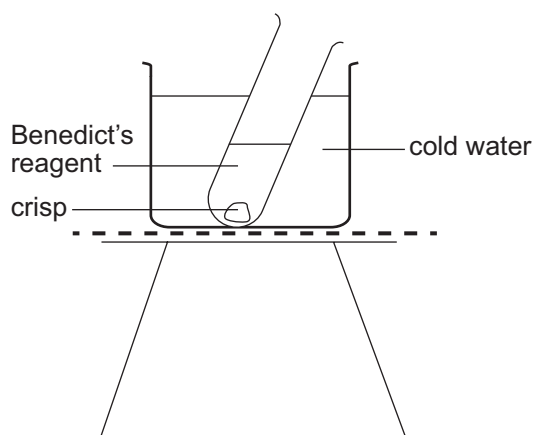
- (i) Complete the sentence below.

The Benedict's reagent changed colour from blue to brick red showing that

_____ was present in the crisp.

[1]

Another student carried out a food test on the **same type of crisp** using the apparatus shown below.

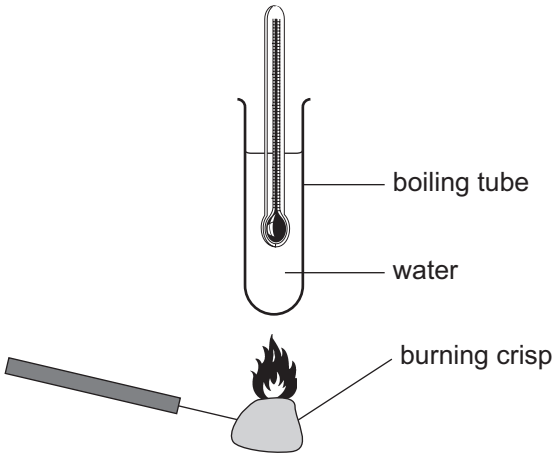


- (ii) Why did the Benedict's reagent **not** change colour in this food test?

[1]



(b) The diagram below shows some of the apparatus used to find the energy content of **different masses** of the same type of crisp.



(i) Place a tick (✓) beside the hypothesis being tested in this experiment.

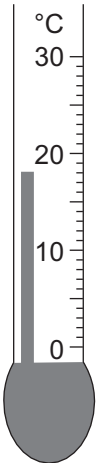
Hypothesis	Tick (✓)
as the type of crisp changes, the temperature rise will increase	
as the mass of crisp increases, the temperature rise will increase	
as the size of crisp increases, the temperature rise will increase	

[1]

[Turn over



The student used a thermometer to measure the temperature of the water before and after the crisp was burnt.



(ii) What temperature is shown on this thermometer?

_____ °C [1]

The results are shown below.

Mass of crisp /g	Temperature before crisp was burnt /°C	Temperature after crisp was burnt /°C	Temperature rise /°C
0.5	17	28	11
1.0	18	39	
1.5	18	52	34

(iii) Calculate the **temperature rise** for a crisp of mass 1.0 g.
Show your working out.

_____ °C [2]



(iv) Predict the **temperature rise** if a crisp of mass 2.0 g was burnt.

_____ °C [1]

(v) Which type of graph should be used to display these results?

Circle your answer.

bar chart : **line graph** : **histogram** [1]

(c) Suggest what effect, if any, moving the crisp **further away** from the boiling tube would have on the temperature rise of the water.

_____ [1]

(d) Give **one** reason why **not** all the energy released from the crisp goes into heating the water in the boiling tube.

_____ [1]

[Turn over



3 The diagrams below show some of the apparatus used to prepare a microscope slide of onion cells.

onion



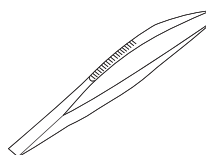
microscope slide



stain



forceps



coverslip



Describe how a student would prepare a microscope slide of onion cells.

Your answer should include:

- the steps taken to prepare a microscope slide of onion cells; and
- the reason for carrying out each step.

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

[6]

[6]

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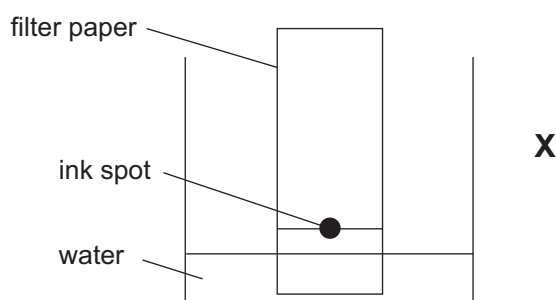
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32GSA4209

Section B – Chemistry

- 4 (a) The apparatus shown below can be used in chromatography to separate the dyes in ink.

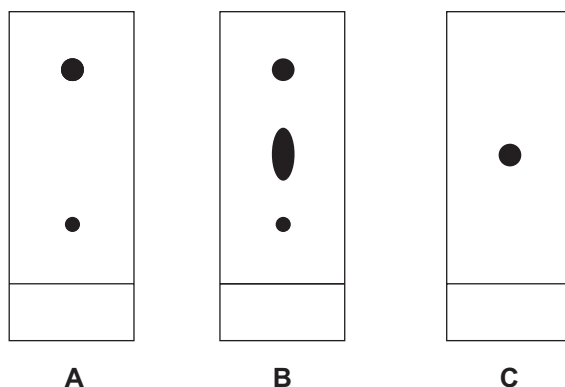


- (i) On the diagram above, draw a line from **X** to the **baseline**. [1]

- (ii) Describe what happens to the water to separate the dyes in the ink.

[1]

The diagrams below show three chromatograms.



- (iii) Which chromatogram, **A**, **B** or **C**, shows the result for a pure substance?

[1]



(iv) On the chromatogram below, circle the spot produced by the **most** soluble dye.



[1]

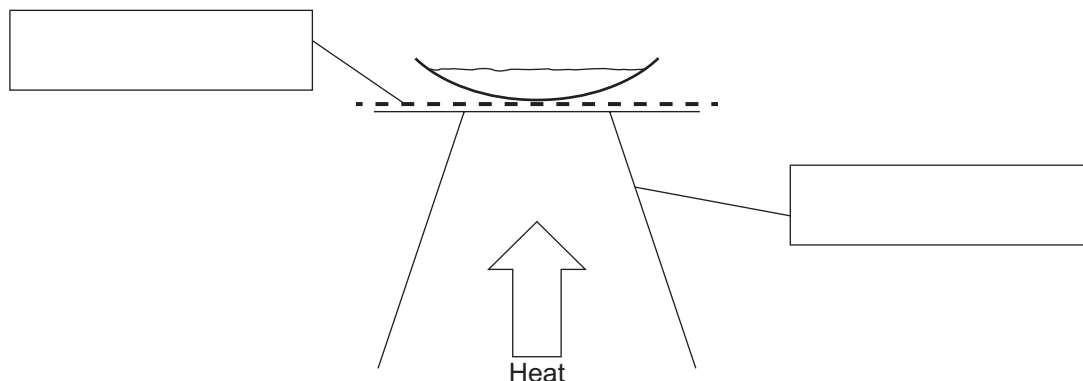
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[Turn over



32GSA4211

- (b) A student used evaporation to separate sugar from a solution of sugar and water. The apparatus she used is shown below.



[2]

- (i) Complete the diagram above by naming the pieces of apparatus in the boxes provided.

Choose from:

tripod : **retort stand**

gauze : **Bunsen burner** : **test tube**

When the separation was complete, solid sugar was left in the evaporating dish.

- (ii) What term is used to describe the solid left after evaporation?

Circle your answer.

solvent **residue** **filtrate**

[1]

- (iii) As a safety precaution, the student left the apparatus to cool for ten minutes before putting it away. Explain why this is necessary.

[1]





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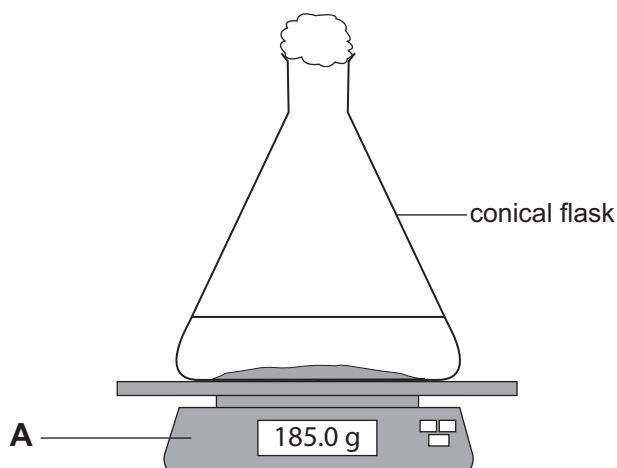
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[Turn over



32GSA4213

- 5 (a) A student investigated the rate of reaction between magnesium carbonate and different concentrations of sulfuric acid using the apparatus below.



- (i) Name the apparatus labelled **A**.

[1]

The student used the following method.

1. Measure 100 cm^3 of sulfuric acid and pour it into the conical flask.
2. Add 1.0 g of magnesium carbonate to the conical flask.
3. Record the mass of the flask and its contents at the start.
4. Record the mass every 20 seconds.
5. Repeat steps 1-4 using different concentrations of acid.

- (ii) Name the gas produced during the reaction of magnesium carbonate and sulfuric acid.

Circle your answer.

oxygen : carbon dioxide : hydrogen [1]



The results are given below.

Concentration of acid / mol/dm^3	Mass of flask and contents /g					
	0 seconds	20 seconds	40 seconds	60 seconds	80 seconds	100 seconds
1.0	185.0	184.9	184.8	184.8	184.7	184.6
1.5	185.0	184.8	184.7	184.6	184.5	184.5
2.0	185.0	184.7	184.6	184.5	184.5	184.5
2.5	185.0	184.6	184.5	184.5	184.5	184.5

(iii) Which concentration of acid had **not** finished reacting after 100 s?

_____ mol/dm^3 [1]

(iv) Which concentration of acid reacted with magnesium carbonate the **fastest**?

_____ mol/dm^3 [1]

(b) Suggest why the student did **not** use acid with a concentration of 10 mol/dm^3 .

_____ [1]

[Turn over



The reaction of **1.5 mol/dm³** acid finished between 60 and 80 seconds.

- (c) At what times, in seconds, should the student record the mass to get the most accurate value for the finishing time?

Circle your answer.

60, 70 and 80

0, 20, 40, 60, 80 and 100

60, 65, 70, 75 and 80

[1]





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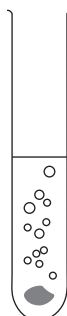
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[Turn over



32GSA4217

- 6 (a) A student investigated the reaction of calcium with different concentrations of acid. He added one piece of calcium to 25 cm³ of acid and timed how long it took for the calcium to disappear.



- (i) Name the apparatus that is used to measure 25 cm³ of acid.

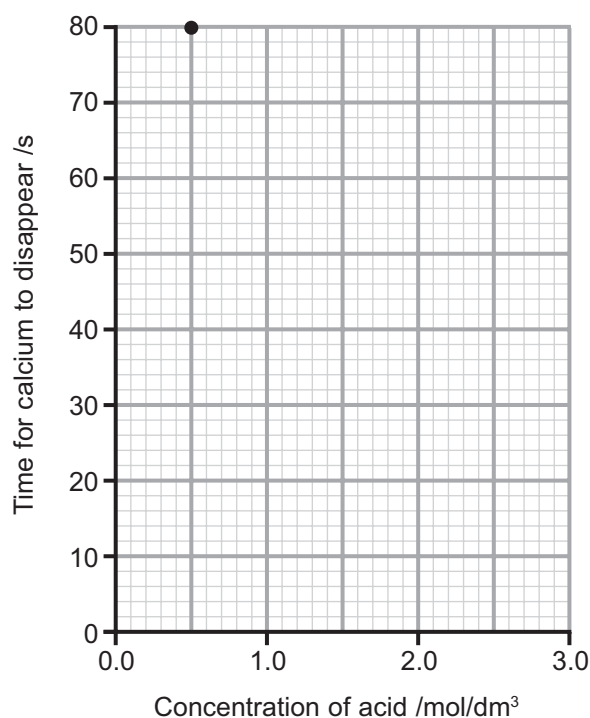
[1]

The results are shown below.

Concentration of acid / mol/dm ³	Time for calcium to disappear /s
0.5	80
1.0	66
1.5	54
2.0	42
2.5	30



- (ii) On the grid below, plot and draw a line graph for these results.
The first point has been plotted for you.



[3]

- (iii) Complete the sentence below to give the trend shown by these results.

As the concentration of acid _____
_____ [1]

- (b) Give **two** things that were kept the same to make this investigation a valid (fair) test.

1. _____
2. _____ [2]

[Turn over



(c) Place a tick (✓) beside the independent variable in this investigation.

Variable	Tick (✓)
volume of acid	
concentration of acid	
temperature of acid	

[1]

(d) The student's teacher suggested that he should repeat the investigation and calculate the average for each concentration. Why is this good scientific practice?

Circle your answer.

to make the results more reliable

to make it a fair test

to make the results more accurate

[1]





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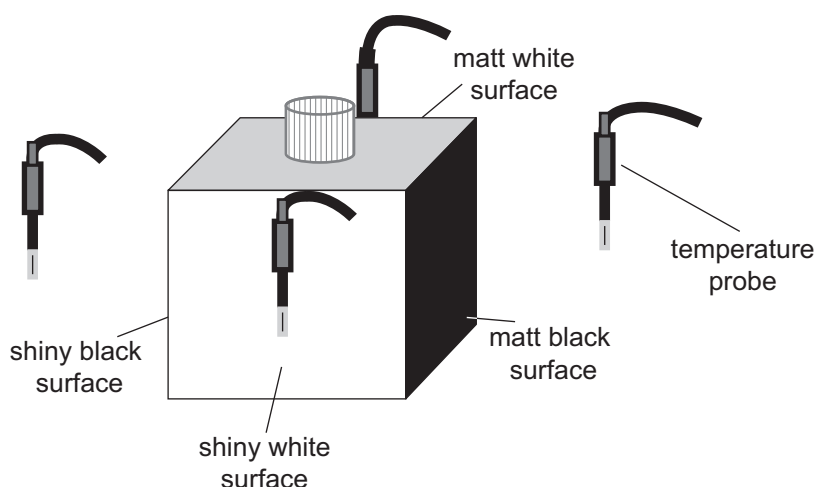
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32GSA4221

Section C – Physics

- 7 The apparatus below was used to investigate how much heat was radiated from the different coloured surfaces of a metal cube.



The cube was filled with boiling water. Temperature probes were placed at the same distance from each surface and the temperature recorded after 2 minutes.

The results are given below.

Surface colour	Temperature /°C
shiny white	32
shiny black	56
matt white	40
matt black	66

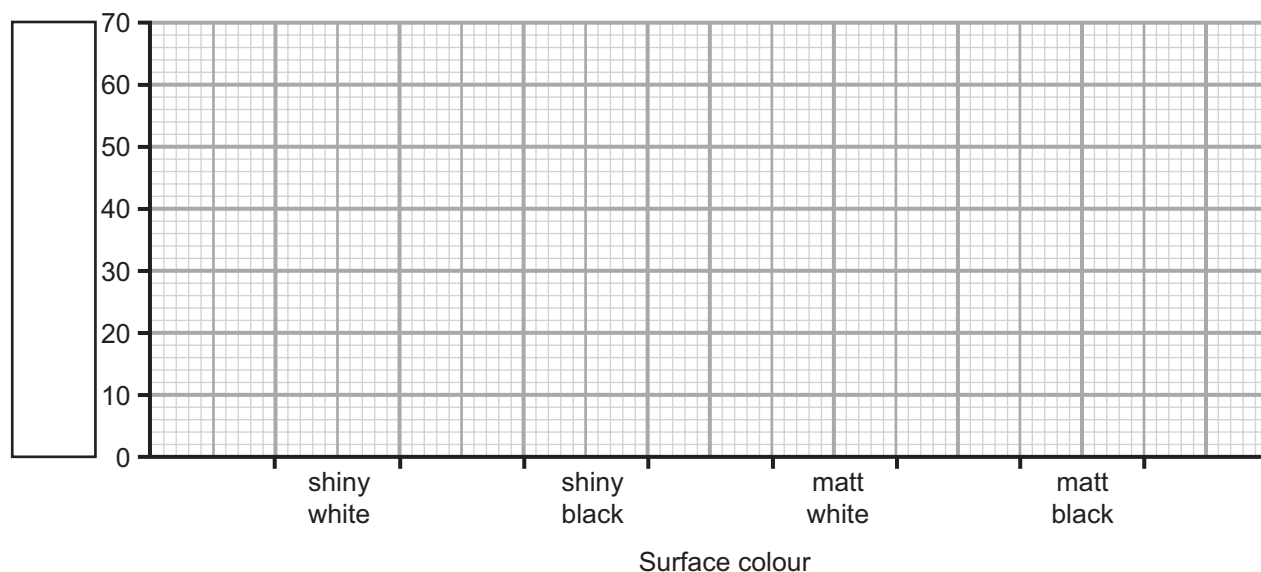
- (a) Calculate the difference between the highest and lowest temperatures recorded.
Show your working out.

_____ °C [2]



(b) On the grid below:

- add a suitable label to the y-axis; and
- draw a bar chart for the results.



[3]

(c) Use the results of this investigation to put the surface colours in order from the best to the worst radiator of heat.

_____ best radiator

_____ worst radiator

[2]

(d) What is the dependent variable in this investigation?

Circle your answer.

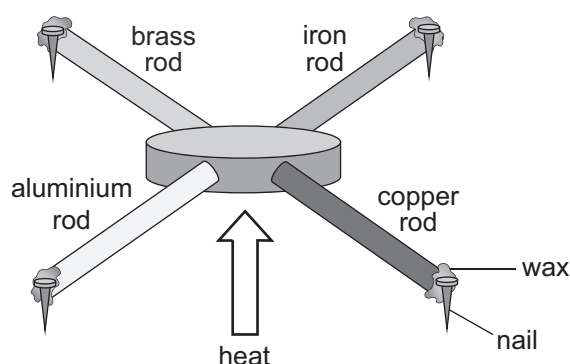
distance of probe : surface colour : temperature

[1]

[Turn over]



- 8 The apparatus below was used to investigate which of four metals was the best conductor of heat.



The rods were heated and the time taken for the nail to fall off each rod was recorded. The investigation was carried out three times. The results are shown below.

Metal	Time taken for nail to fall /s			
	Attempt 1	Attempt 2	Attempt 3	Average time
brass	54.2	59.6	57.8	57.2
copper	22.1	22.6	19.8	
iron	80.0	84.5	83.4	82.6
aluminium	30.7	35.3	7.3	33.0

- (a) Calculate the average time taken for the nail to fall from the **copper** rod.
Show your working out.

_____ s [2]

One of the times recorded for the **aluminium** rod was an anomaly.

- (b) Circle the anomalous result in the table above. [1]



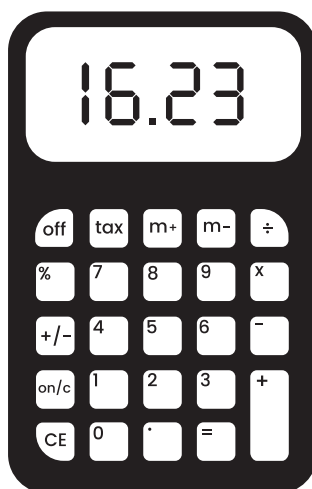
(c) Which metal in the investigation was the **worst** conductor of heat?

_____ [1]

(d) Explain why the nails fell off the rods during this investigation.

_____ [1]

This student tested another metal and the average time calculated is shown below.



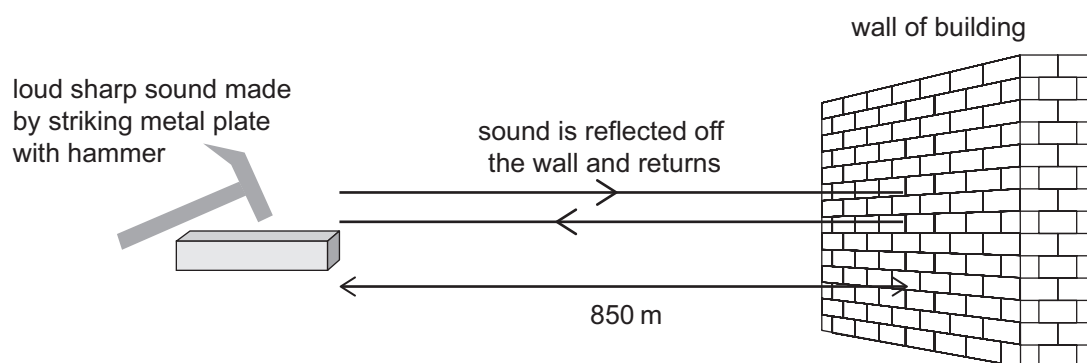
(e) Give this value to **one** decimal place.

_____ s [1]

[Turn over



- 9 (a) The diagram below shows the echo method used to find the speed of sound.



The echo time is the time taken for the sound to travel to the wall and back.

- (i) Describe what a student needs to do to find the echo time.

[2]

The echo time was measured as 5.0 s.

- (ii) Calculate the time taken for the sound to travel to the wall.

_____ s [1]

- (iii) Which equation is used to calculate the speed of sound?

Circle your answer.

$$\text{speed} = \text{distance} \times \text{time}$$

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{speed} = \frac{\text{time}}{\text{distance}}$$

[1]



(b) The table below shows the speed of sound at different air temperatures.

Air temperature / °C	Speed of sound / m/s
5	334
10	337
15	340
20	343
25	346

(i) Complete the sentence below to give the trend shown by these results.

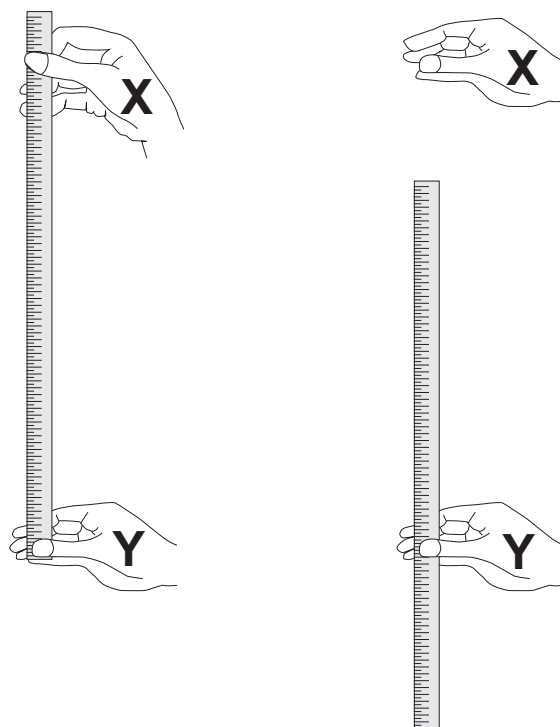
As the air temperature _____
_____ [1]

(ii) Predict a value for the speed of sound at 30°C.

_____ m/s [1]



10 A student investigated the effect of an energy drink on another student's reactions.



The student followed the steps below.

1. Student **Y** holds out their hand with a gap between their thumb and first finger.
2. Student **X** holds the ruler so that student **Y**'s thumb is at the 0 cm mark.
3. Student **X** drops the ruler and student **Y** catches it.
4. The distance the ruler falls before student **Y** catches it is recorded.
5. An energy drink is taken and after 10 minutes steps 1-4 are repeated.

(a) Explain why step **2** is important.

[1]

(b) In step 5, which student, **X** or **Y**, should take the energy drink? Explain your answer.

[1]



The results are shown in the table below.

	Distance ruler falls /cm
without energy drink	18.6
with energy drink	10.4

(c) What effect, if any, did taking an energy drink have on this student's reactions?

[1]

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For Examiner's use only	
Question Number	Marks
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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

THE PERIODIC TABLE OF ELEMENTS
Group

																0
																4
																2
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* 58 – 71 Lanthanum series
† 90 – 103 Actinium series



a = relative atomic mass (approx)
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