



General Certificate of Secondary Education
2024–2025

Centre Number

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Candidate Number

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Single Award Science: Chemistry

Unit 2
Higher Tier



[GSA22]

GSA22

TUESDAY 12 NOVEMBER 2024, 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 questions in black ink and use a dark HB pencil for drawings and graphs.

Do not write with a gel pen.

Answer **all 8** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is **60**.

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 **2(a)**.

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

14849



20GSA2201

- 1 A student added **four** powdered metals, zinc, aluminium, magnesium and iron, to acid and measured the **temperature rise** for each metal.

The method the student used is given below but the steps are **not** in the correct order.

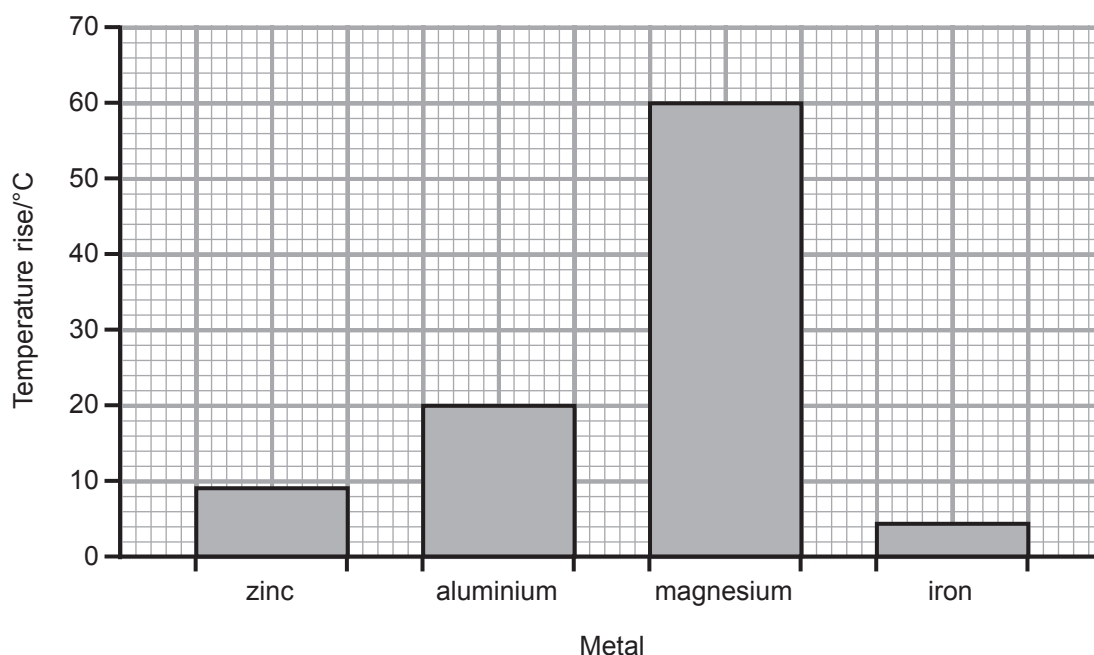
- A. Add zinc to the acid and measure the maximum temperature of the reaction.
- B. Repeat the experiment using each of the other metals.
- C. Measure the starting temperature of the acid.
- D. Measure 20 cm³ of acid into a polystyrene cup.
- E. Calculate the temperature rise for zinc.

- (a) Use the letters **A, B, C, D** and **E** to put the steps in the correct order.
One has been done for you.

D → _____ → _____ → _____ → _____

[2]

The student's results are shown below.



(b) The greater the temperature rise, the more reactive the metal.

(i) Use the results in the bar chart to put the four metals in order of reactivity. Put the most reactive metal first.

_____ most reactive

_____ least reactive



[2]

The starting temperature of the acid for the **magnesium** reaction was 20 °C.

(ii) Use the results in the bar chart to calculate the **maximum** temperature for the magnesium reaction.

_____ °C [1]

(c) What term is used to describe chemical reactions that give out heat?

_____ [1]

[Turn over



2 The burning of hydrocarbons is a major source of atmospheric pollution.



- (a) Describe the greenhouse effect and how burning hydrocarbons can cause an increase in the greenhouse effect.

Your answer should include:

- the definition of a hydrocarbon;
- the names of the two products formed when hydrocarbons burn; and
- **two** environmental problems associated with the greenhouse effect.

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

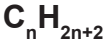




[6]

(b) Butane is an alkane. What is the general formula for alkanes?

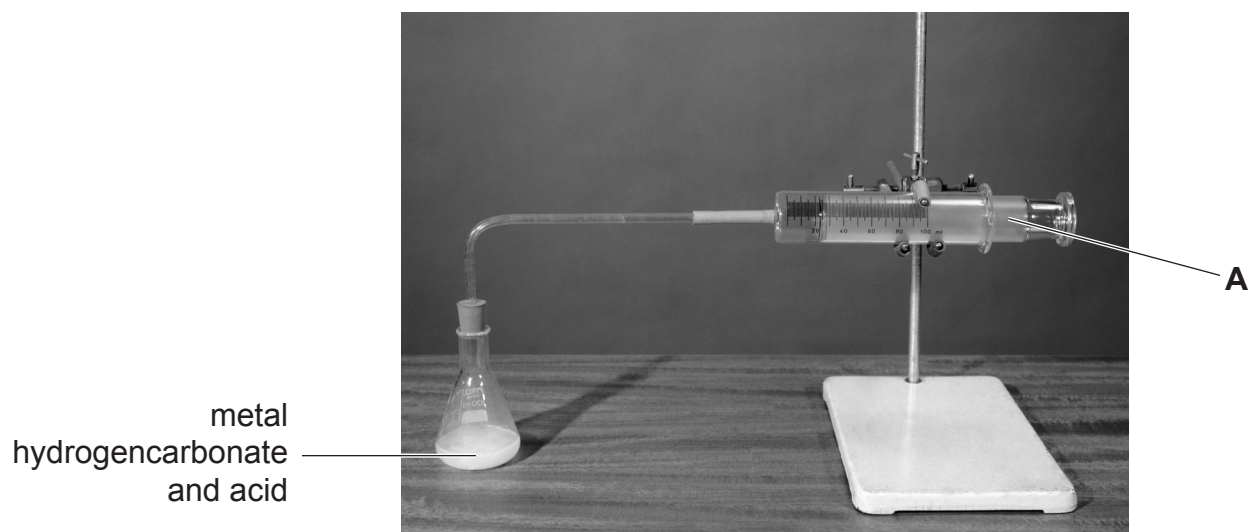
Circle your answer.



[1]



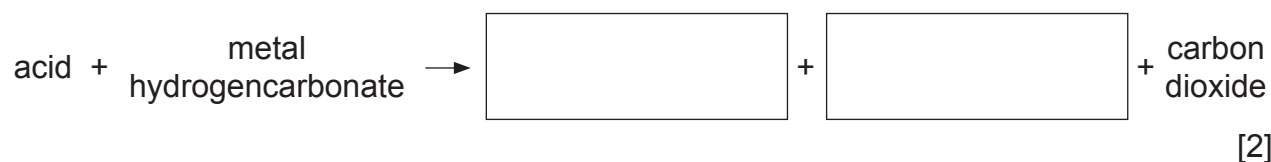
- 3 Carbon dioxide gas is produced when acid is added to a metal hydrogencarbonate. The gas can be collected using the apparatus below.



- (a) Give the name of the piece of apparatus labelled **A**.

_____ [1]

- (b) Complete the general word equation for the reaction between an acid and a metal hydrogencarbonate.

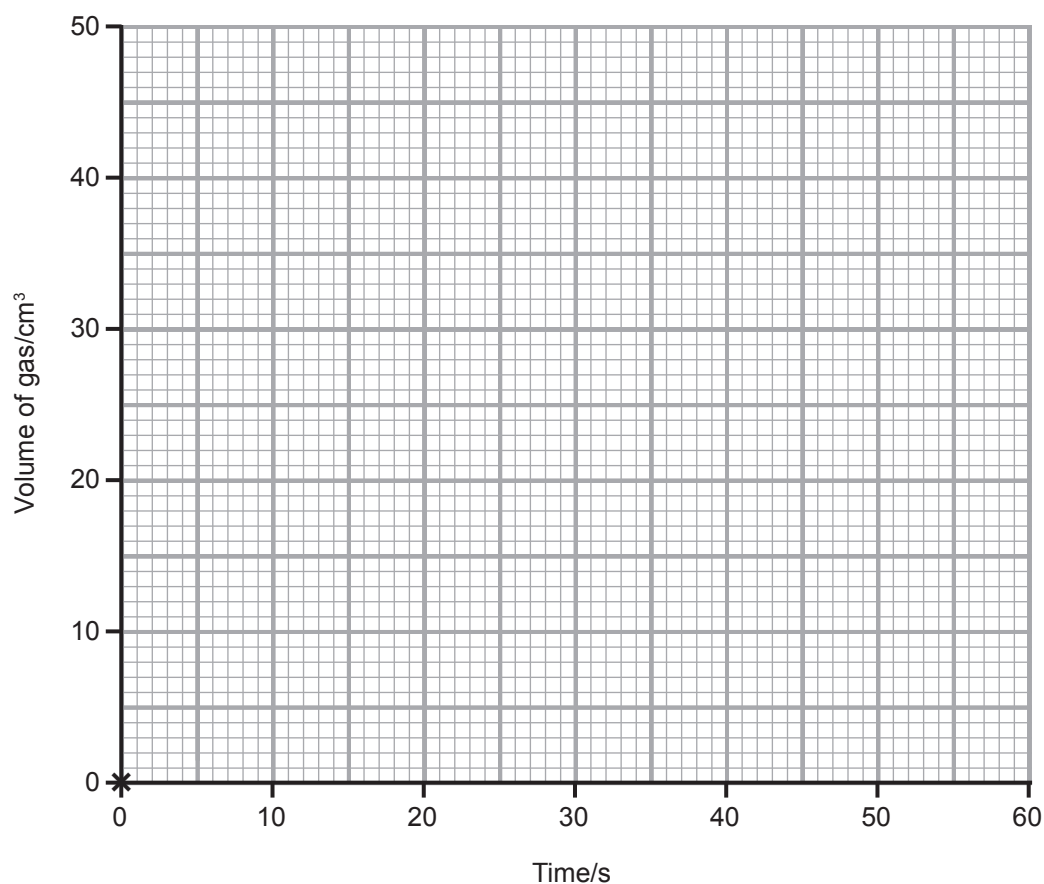


- (c) The table below shows the volume of carbon dioxide gas produced by this reaction over 60 seconds.

Time/s	0	10	20	30	40	50	60
Volume of gas/cm ³	0.0	28.0	40.0	45.0	47.5	47.5	47.5



- (i) On the grid below plot and draw a **line graph** for these results. The first point is plotted for you.



- (ii) Describe fully the trend shown by these results.

[2]

- (iii) What effect, if any, would an increase in temperature have on the rate of this reaction?

[1]

- (d) The experiment was repeated with a more concentrated acid. Explain, in terms of particles, why the rate of the reaction increased.

[2]

[Turn over



4 (a) Potassium has an atomic number of 19.

(i) What is meant by the term **atomic number**?

[1]

(ii) Complete the table below about the subatomic particles in a potassium atom.

Subatomic particle	Number present in a potassium atom	Relative charge of particle	Relative mass of particle
proton	19		
neutron			1
electron		-1	

[3]

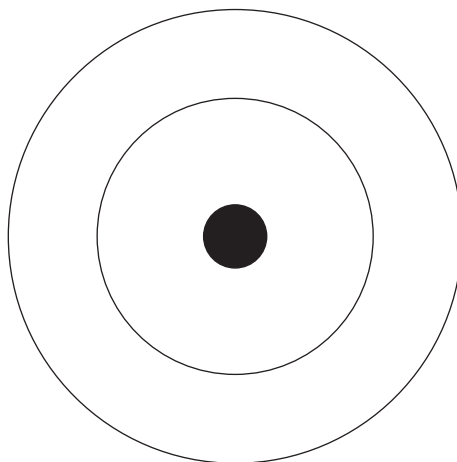
(iii) Explain, in terms of electrons, how a potassium ion is formed from a potassium atom.

[2]



(b) Fluorine has an atomic number of 9.

(i) Complete the diagram below to show the electronic structure of a **fluoride ion**.



[1]

(ii) What is the symbol for a fluoride ion?

_____ [1]

Potassium fluoride is made when a potassium ion forms a strong bond with a fluoride ion.

(c) Explain why the ionic bond between potassium and fluorine is strong.

_____ [1]

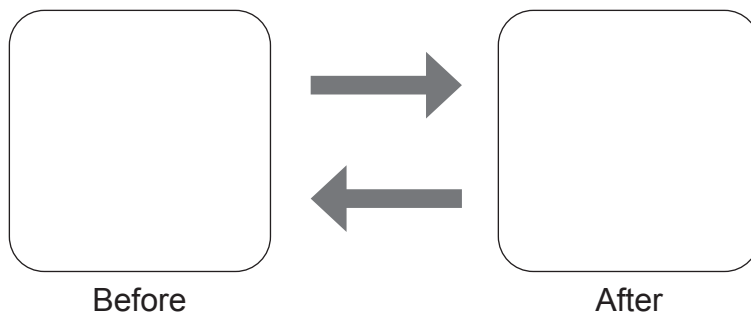
[Turn over



5 Dry ice is the solid form of carbon dioxide that **sublimes** at $-78\text{ }^{\circ}\text{C}$.

(a) Complete the diagram below to show the arrangement of particles before and after sublimation.

Use  to represent a particle.



[1]

The table below gives the melting point and the boiling point for some substances.

Substance	Melting point/ $^{\circ}\text{C}$	Boiling point/ $^{\circ}\text{C}$
water	0	100
dilute hydrochloric acid	-35	70
ammonia	-78	-33
sodium chloride	801	1465
carbon monoxide	-205	-191
sulfur dioxide	-73	-10

(b) What is meant by the term **melting point**?

[1]



(c) Use information from the table and your knowledge to answer the following questions.

(i) Name the substance which has the **lowest** boiling point.

_____ [1]

(ii) How many of these substances are **gases** at room temperature (20 °C)?

_____ [1]

(iii) In what state will sulfur dioxide be at a temperature of **-20 °C**?

_____ [1]

[Turn over



6 (a) The table below gives information about five different substances.

Substance	pH range	Colour of universal indicator
A	7	green
B	3–6	orange/yellow
C	12–14	
D	8–11	blue
E	0–2	

Use this information and your knowledge to answer the following questions.

(i) Complete the table to give the colour of universal indicator in substances C and E. [1]

(ii) Which substance A, B, C, D or E could be:

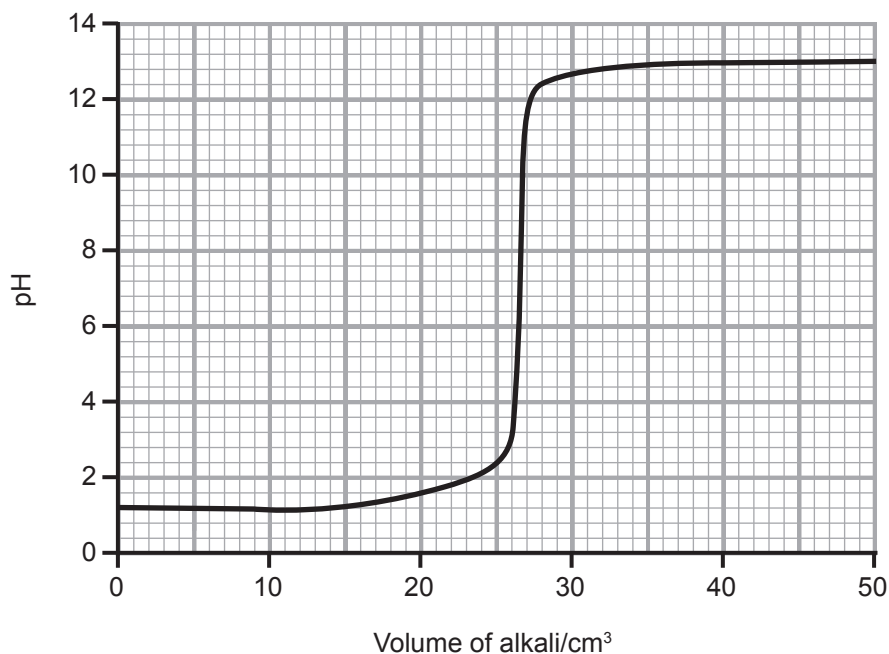
sodium hydroxide? _____

ethanoic acid? _____ [2]



- (b) A student measured the pH changes during the reaction between an acid and an alkali. He placed 20 cm³ of acid into a conical flask and then slowly added the alkali.

The results are shown on the graph below.



Use this information to answer the following questions.

- (i) What was the pH of the acid used in this investigation?

_____ [1]

- (ii) What volume of alkali was needed to neutralise the acid?

_____ cm³ [1]

[Turn over



In another investigation, the student reacted some copper oxide with sulfuric acid to produce copper sulfate.

The word equation for this reaction is shown below.

copper oxide + sulfuric acid → copper sulfate + water

(c) Complete the balanced symbol equation for this reaction.



[2]





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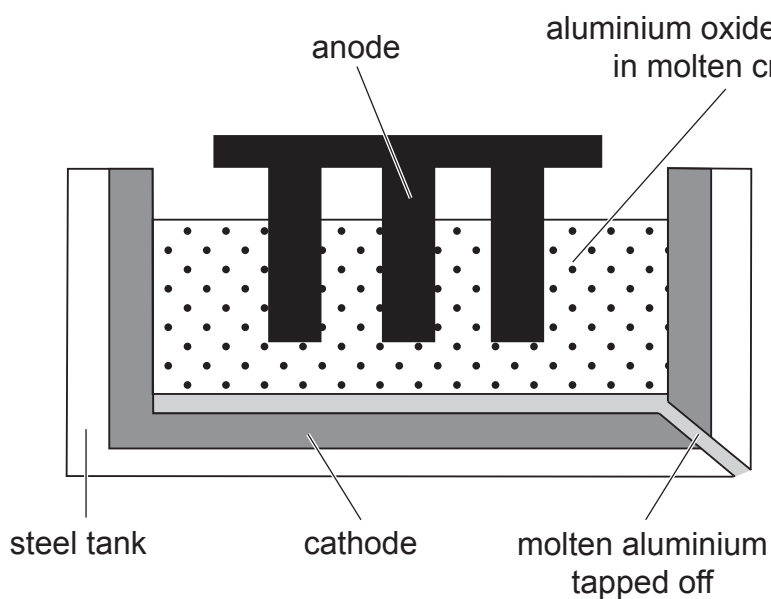
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[Turn over



20GSA2215

7 Aluminium can be extracted from its ore using electrolysis, as shown below.



(a) What is meant by the term **electrolysis**?

[2]

(b) Name the ore of aluminium.

[1]

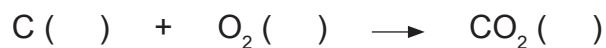
(c) Describe, in terms of electrons, what happens at the cathode to form aluminium.

[2]



(d) The carbon anode must be replaced periodically as the oxygen produced at the anode reacts with it, causing the anode to wear away.

(i) Add state symbols to the balanced symbol equation below.



[1]

(ii) Give **one** reason why carbon is used to make the electrodes.

[1]

(e) Give **one** reason why it is important to recycle aluminium.

[1]

[Turn over



8 Alkanes and alkenes are organic molecules.

(a) Complete the table below.

Organic molecule	Molecular formula	Structural formula
methane		$\begin{array}{c} \text{H} \\ \\ \text{H} - \text{C} - \text{H} \\ \\ \text{H} \end{array}$
	C_3H_8	$\begin{array}{ccccccc} & \text{H} & & \text{H} & & \text{H} & \\ & & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - \text{H} \\ & & & & & & \\ & \text{H} & & \text{H} & & \text{H} & \end{array}$
butene	C_4H_8	

[3]

(b) Another organic molecule, ethene, can be used to make polythene.

(i) What term is used to describe the small ethene molecules that can join together to form polythene?

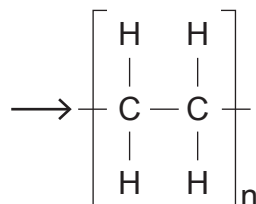
_____ [1]

(ii) What is the name of the process that takes place to form polythene?

_____ [1]



(iii) Complete the balanced symbol equation below to show the formation of polythene from ethene.



[2]

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Question 7 Principal Examiner

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Question Number	Marks
1	
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Total Marks	
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Examiner Number

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