



General Certificate of Secondary Education
2025

Centre Number

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Candidate Number

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GCSE Chemistry

Unit 1

Foundation Tier

MV18

[GCM11]

MONDAY 19 MAY, MORNING

Time

1 hour, plus your additional time allowance.

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 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 **five** questions.

Information for Candidates

The total mark for this paper is 60.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

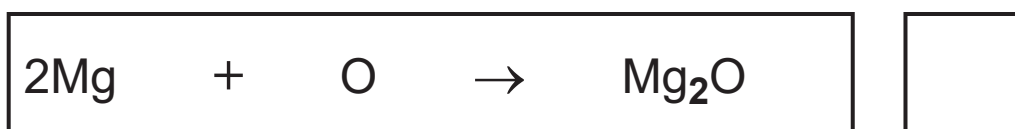
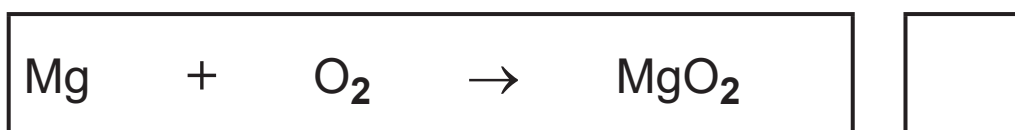
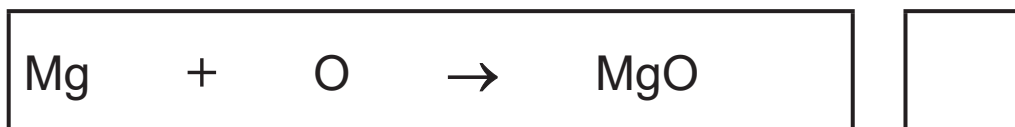
You may use a scientific calculator.

Quality of written communication will be assessed in
Question **2(b)**.

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

1 Magnesium reacts with oxygen to form magnesium oxide.

(a) Which one of the following shows the correct balanced symbol equation for the reaction of magnesium with oxygen? Tick (✓) the box on the right to indicate your choice. [1 mark]



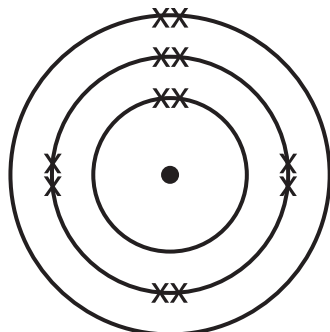
(b) The table below shows some properties of magnesium, oxygen and magnesium oxide.

Physical property	Magnesium	Oxygen	Magnesium oxide
Melting point /°C	650	-218	2852
Boiling point /°C	1090	-183	3600
State at room temperature (25°C)			
Colour at room temperature (25°C)			

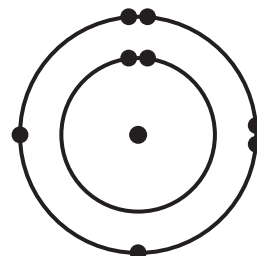
(i) Complete the table above. [3 marks]

(ii) The bonding in magnesium oxide is ionic bonding. Explain what is meant by ionic bonding. [1 mark]

(iii) Complete the dot and cross diagram below by drawing the electronic configurations of the ions formed and write the formulae of the ions.
[4 marks]



magnesium atom



oxygen atom

magnesium ion

Formula _____

oxide ion

Formula _____

(iv) A dot and cross diagram for a molecule of oxygen is shown below.



For the molecule shown, complete the following:

[3 marks]

Total number of electrons shown _____

Number of lone pairs of electrons _____

Number of electrons in covalent bonds _____

(c) Magnesium oxide is also formed when magnesium reacts with carbon dioxide.

(i) Write the formula for carbon dioxide. [1 mark]

(ii) Draw a dot and cross diagram to show the bonding in a molecule of carbon dioxide. [1 mark]

2 A version of the Periodic Table devised by Dmitri Mendeleev is shown below.

Some elements, such as zinc, are in different positions in Mendeleev's Periodic Table compared to the modern Periodic Table.

H 1									
Li 7	Be 9	B 11	C 12	N 14	O 16	F 19			
Na 23	Mg 24	Al 27	Si 28	P 31	S 32	Cl 35.5			
K 39	Ca 40		Ti 48	V 51	Cr 52	Mn 55	Fe 56	Co 59	Ni 59
Cu 64	Zn 65			As 75	Se 79	Br 80			
Rb 86	Sr 88	Y 89	Zr 91	Nb 93	Mo 96		Ru 101	Rh 103	Pd 106
Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127			

(a) Suggest one reason why Mendeleev placed zinc in the same group as calcium and magnesium. [1 mark]

(c) Using the Periodic Table in your Data Leaflet, identify the elements below from the information given.

[1 mark for each]

(i) A transition metal which forms a black oxide and a green carbonate.

(ii) The most reactive halogen.

(iii) The element in Period 2 and Group 5.

(iv) The element with atomic number 18.

(d) Group 1 elements react with water.

(i) State the name given to Group 1. [1 mark]

(ii) Complete the balanced symbol equation below for the reaction of potassium with water. [1 mark]



(iii) When potassium reacts with water, heat is released and the potassium eventually disappears with a crackle forming a colourless solution. State two other observations made when potassium reacts with water. [2 marks]

1. _____

2. _____

3 (a) Many elements exist as isotopes.

Which two of the following statements are true for isotopes? Tick (✓) the boxes on the right to indicate your choices. [1 mark]

Isotopes have the same number of protons but a different number of neutrons

Isotopes have the same number of protons but a different number of electrons

Isotopes have the same atomic number but a different mass number

Isotopes have the same mass number but a different atomic number

(b) The table below gives some information about the atomic structure of five different atoms and ions.

Complete the table. [5 marks]

Atom/ion	Number of protons	Number of electrons
Li	3	
F ⁻	9	
H ⁺		0
Ca ²⁺		18
	17	18

4 Acids react with alkalis and with metal carbonates to form salts.

(a) The reactions of acids occur because of the presence of hydrogen ions in solution.

(i) Write the formula of a hydrogen ion. [1 mark]

(ii) **Name** the ion present in all alkalis. [1 mark]

(iii) The hazard symbol below is often found on bottles of acids and alkalis.



What do you understand by this symbol? [1 mark]

(b) The table below shows some common laboratory chemicals.

	Chemical
A	hydrochloric acid
B	ammonia solution
C	ethanoic acid
D	sodium hydroxide
E	deionised water

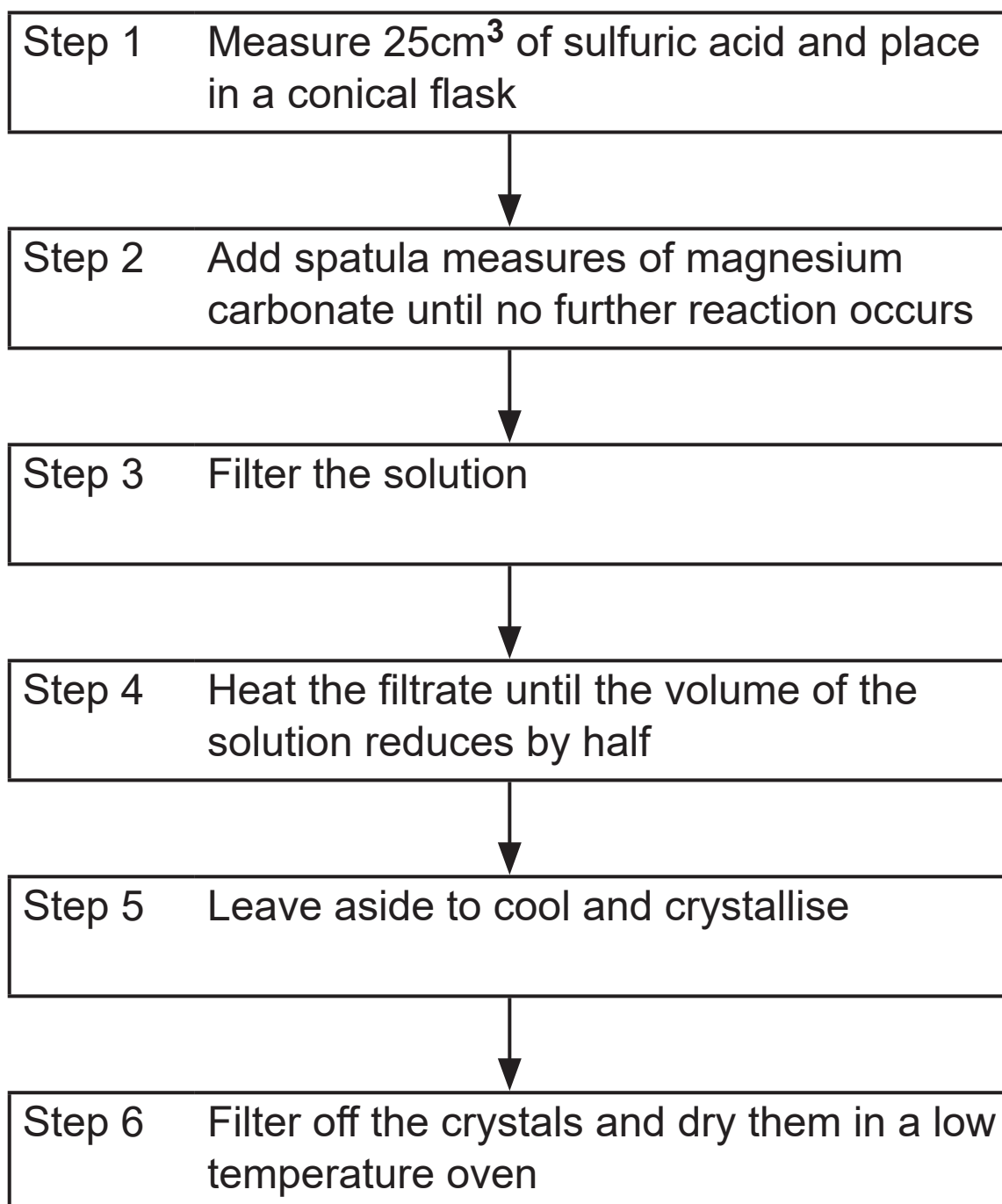
(i) Which one of the chemicals (**A**, **B**, **C**, **D** or **E**) would have the highest pH? [1 mark]

(ii) Which one of the chemicals (**A**, **B**, **C**, **D** or **E**) would have the lowest pH? [1 mark]

(iii) What colour is observed when phenolphthalein is added to **D**? [1 mark]

(iv) Write a balanced symbol equation for the reaction which occurs between **A** and **D**. [2 marks]

(c) The salt, magnesium sulfate, may be prepared using the steps shown in the flow scheme below.



(i) Apart from magnesium sulfate, name the other two products of the reaction between magnesium carbonate and sulfuric acid. [1 mark]

1. _____
2. _____

(ii) What piece of apparatus is used to measure out 25cm^3 of sulfuric acid in Step 1? [1 mark]

(iii) How would you know that no further reaction was occurring in Step 2? [1 mark]

(iv) Name the three pieces of apparatus required to filter the solution in Step 3. [3 marks]

1. _____

2. _____

3. _____

(v) Explain why the solution is heated to half volume in Step 4. [1 mark]

(vi) State one other method which could be used to dry the crystals in Step 6. [1 mark]

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5 Aluminium forms a variety of compounds with non-metals.

(a) 0.81 g of aluminium reacted with sulfur and formed 2.09 g of a sulfide of aluminium.

(i) Calculate the mass of sulfur which reacted.
[1 mark]

mass of sulfur = _____ g

(ii) Calculate the number of moles of sulfur which reacted. [1 mark]

moles of sulfur = _____

(iii) Calculate the number of moles of aluminium which reacted. [1 mark]

moles of aluminium = _____

(b) Aluminium oxide reacts with nitric acid to form aluminium nitrate and water.

Complete the table below. [3 marks]

	Aluminium oxide	Aluminium nitrate	Water
Formula	Al_2O_3	$\text{Al}(\text{NO}_3)_3$	H_2O
Number of oxygen atoms in one formula	3		
Relative formula mass (M_r)		213	18

(c) A sample of hydrated aluminium nitrate, $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$, was heated to remove all of the water of crystallisation.

(i) Complete the sentence below to explain what is meant by the term water of crystallisation.
[2 marks]

Water of crystallisation is water which is chemically _____ into the crystalline _____ .

(ii) State how you would ensure all of the water of crystallisation was removed. [1 mark]

This is the end of the question paper

Source

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Question Number	Marks
1	
2	
3	
4	
5	
Total Marks	

Examiner Number

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