AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.3.1.3

Mass changes when a reactant or product is a gas

Past-paper questions

Tier	**Foundation**
Question groups	**3**
Available paper years	**2018–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

5.3.1.3 Mass changes when a reactant or product is a gas

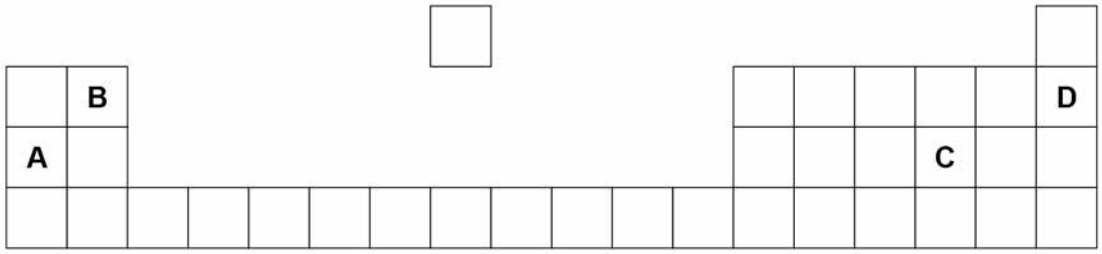
Question 01

June 2018 | 8464/C/1F | Original Q4

0 4 This question is about the elements in Group 2 of the periodic table.

0 4 . 1 **Figure 9** shows the positions of four elements, **A**, **B**, **C**, and **D**, in the periodic table.

Figure 9



Which element is in Group 2?

[1 mark]

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

Question 4 continues on the next page

5.3.1.3 Mass changes when a reactant or product is a gas

Question 01 · continued June 2018 | 8464/C/1F | Original Q4

Group 2 metal carbonates break down when heated to produce a metal oxide and a gas.

metal carbonate → metal oxide + gas

0 4 . 2 Name the two products when calcium carbonate ($CaCO_3$) is heated.

[2 marks]

_____ and _____

0 4 . 3 What type of reaction happens when a compound breaks down?

[1 mark]

Tick **one** box.

- burning ☐
- decomposition ☐
- neutralisation ☐
- reduction ☐

0 4 . 4 The metal carbonate takes in energy from the surroundings to break down.

What type of reaction takes in energy from the surroundings?

[1 mark]

Tick **one** box.

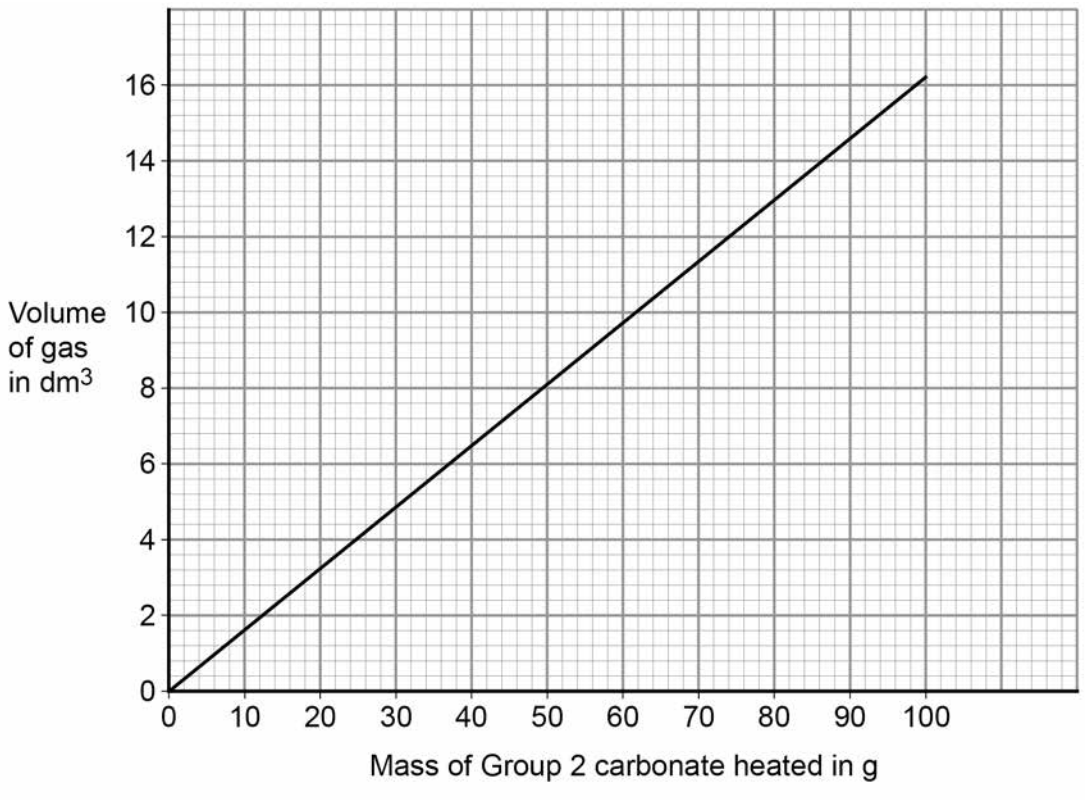
- combustion ☐
- electrolysis ☐
- endothermic ☐
- exothermic ☐

5.3.1.3 Mass changes when a reactant or product is a gas

Question 01 · continued

0 4 . 5 **Figure 10** shows the volume of gas produced when a Group 2 metal carbonate is heated.

Figure 10



The student collected 5.2 dm^3 of gas.

What mass of the Group 2 metal carbonate is heated?

[1 mark]

Mass = _____ g

0 4 . 6 Calculate the mass of the Group 2 carbonate needed to produce 24 dm^3 of gas.

Use your answer from question **04.5** to help you.

[2 marks]

_____

_____

_____

_____

Mass = _____ g

5.3.1.3 Mass changes when a reactant or product is a gas

Question 01 · continued

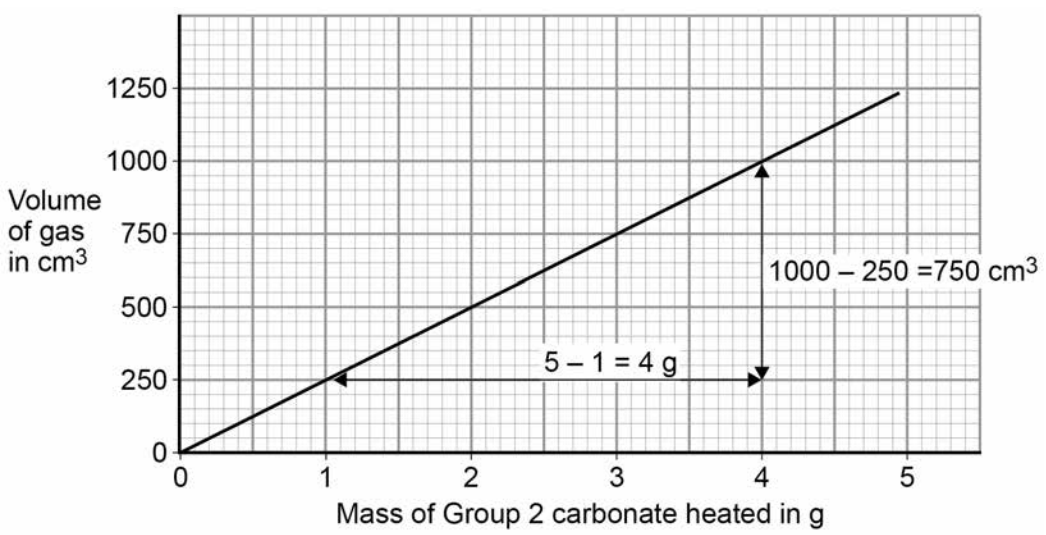
0 4 . 7 A student heated different masses of a Group 2 carbonate. The student measured the volume of gas produced.

Figure 11 shows a graph of the student's results.

The student calculates the gradient of the line in **Figure 11**

The student makes **two** mistakes.

Figure 11



Correct formula for gradient = $\frac{\text{Increase in volume of gas}}{\text{Increase in mass of Group 2 metal carbonate heated}}$

Student's calculation = $\frac{4}{750}$ = 0.00533 cm^3 per g

Identify the **two** mistakes the student makes.

Calculate the correct gradient of the line.

[4 marks]

Mistake 1 _____

_____

Mistake 2 _____

_____

Calculation _____

_____

Gradient = _____ cm^3 per g

5.3.1.3 Mass changes when a reactant or product is a gas

Question 01 · continued

0 4 . 8 A student repeated the experiment with a different Group 2 metal carbonate (**X**CO_3).

The relative formula mass (M_r) of **X**CO_3 is 84

Relative atomic masses (A_r): C = 12 O = 16

Calculate the relative atomic mass (A_r) of **X**.

Name metal **X**.

Use the periodic table.

[4 marks]

Relative atomic mass (A_r) = _____

Metal **X** is _____

16

5.3.1.3 Mass changes when a reactant or product is a gas

Question 02

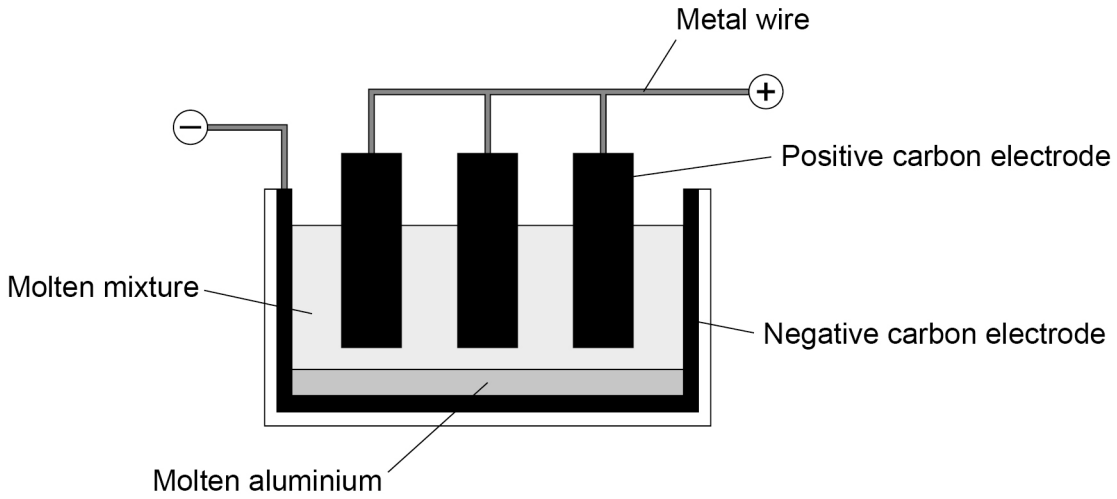
June 2023 | 8464/C/1F | Original Q5

0 5 This question is about extraction of metals.

Aluminium is extracted from a molten mixture of aluminium oxide and cryolite using electrolysis.

Figure 12 shows the electrolysis cell.

Figure 12



0 5 . 1 Complete the sentence.

[1 mark]

The extraction of aluminium is expensive because the process uses large amounts of _____ .

0 5 . 2 Oxygen is produced at the positive carbon electrodes.

The oxygen reacts with the carbon electrodes.

Which gas is produced when oxygen reacts with the positive carbon electrodes?

[1 mark]

_____

5.3.1.3 Mass changes when a reactant or product is a gas

Question 02 · continued June 2023 | 8464/C/1F | Original Q5

Titanium is extracted from titanium chloride by reacting titanium chloride with sodium.

The reaction between titanium chloride and sodium is carried out in an inert atmosphere.

0 5 . 3 Suggest why the reaction is carried out in an inert atmosphere.

[1 mark]

0 5 . 4 Complete the sentence.

Choose the answer from the box.

[1 mark]

argon	**chlorine**	**hydrogen**

The gas used for the inert atmosphere is _____ .

0 5 . 5 Balance the equation for the reaction.

[1 mark]

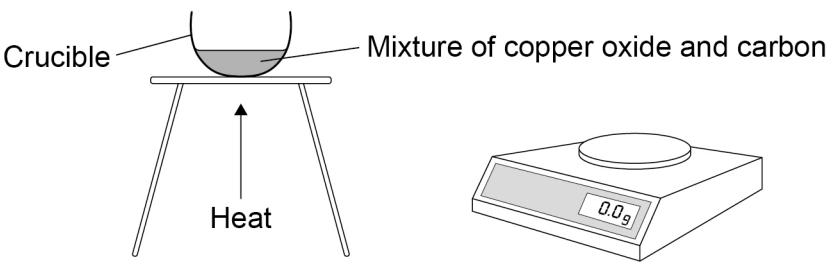
$$TiCl_4 + 4\,Na \rightarrow Ti + ____\ NaCl$$

Question 02 · continued

Copper is extracted from copper oxide by reacting copper oxide with carbon.

Figure 13 shows the apparatus.

Figure 13



The equation for the reaction is:

$$2\,CuO(s) + C(s) \rightarrow 2\,Cu(s) + CO_2(g)$$

In an experiment 15.9 g of copper oxide and 1.2 g of carbon reacted.

12.7 g of copper was produced in the reaction.

0 5 . 6 Calculate the mass of carbon dioxide produced in this experiment.

[1 mark]

Mass of carbon dioxide = _____ g

0 5 . 7 Explain why the mass of the contents in the crucible changed during the experiment.

[2 marks]

5.3.1.3 Mass changes when a reactant or product is a gas

Question 02 · continued

0 5 . 8 What happens to copper oxide in the reaction?

Give **one** reason for your answer.

Use the equation for the reaction.

[2 marks]

Tick (✓) **one** box.

The copper oxide is dissolved ☐

The copper oxide is oxidised ☐

The copper oxide is reduced ☐

Reason _____

_____

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Turn over for the next question

5.3.1.3 Mass changes when a reactant or product is a gas

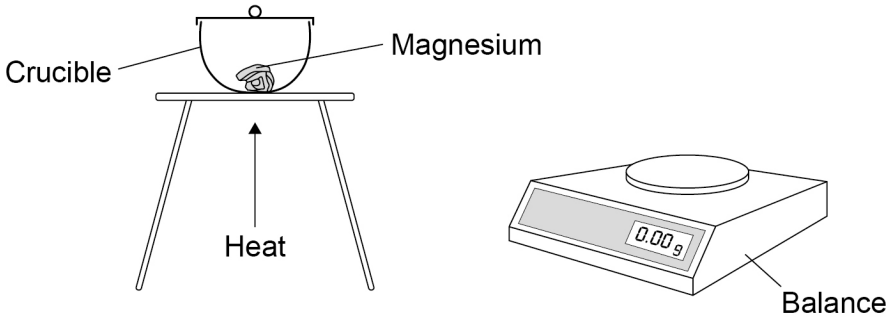
Question 03

June 2025 | 8464/C/1F | Original Q3

0 3 A student investigated the reaction of magnesium with oxygen.

Figure 6 shows the apparatus.

Figure 6



This is the method used.

1. Measure the mass of an empty crucible.
2. Add 0.10 g of magnesium to the crucible.
3. Heat the crucible and contents for 5 minutes.
4. Allow to cool and measure the mass of the crucible and contents.
5. Repeat steps 1 to 4 using different masses of magnesium.

0 3 . 1 Complete the word equation for the reaction.

[1 mark]

magnesium + oxygen ⟶ _____

0 3 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

decomposed	**oxidised**	**reduced**

When magnesium reacts with oxygen, the magnesium is _____.

5.3.1.3 Mass changes when a reactant or product is a gas

Question 03 · continued

Table 3 shows the measurements for one of the experiments.

Table 3

	Mass in grams
Empty crucible	20.25
Crucible and magnesium **before** heating	20.55
Crucible and contents **after** heating	20.75

0 3 . 3 Calculate the mass of magnesium in the crucible **before** heating.

[1 mark]

Mass of magnesium = _____ g

0 3 . 4 Why does the reaction result in an increase in the mass of the contents of the crucible?

[1 mark]

Tick (✓) **one** box.

A solid reacts with a gas to produce a solid. ☐

Some of the product escapes from the crucible. ☐

The reactants have a greater mass than the product. ☐

Question 3 continues on the next page

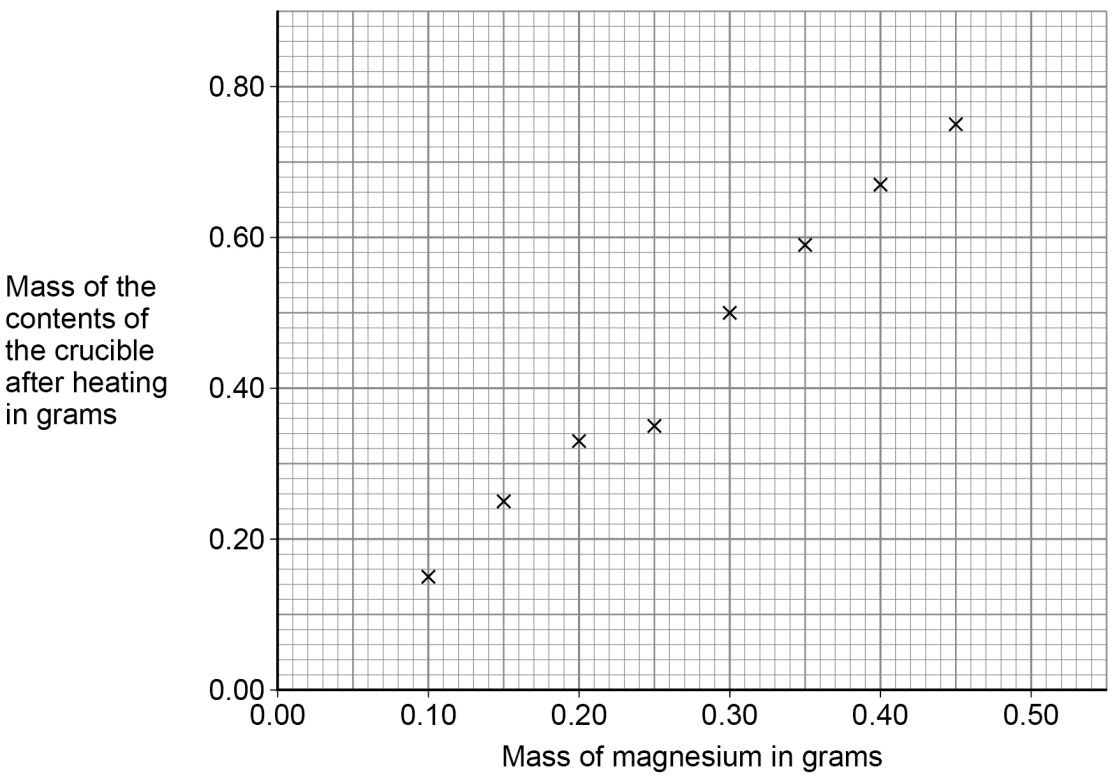
5.3.1.3 Mass changes when a reactant or product is a gas

Question 03 · continued

0 3 . 5 The student determined the mass of the contents of the crucible after heating each mass of magnesium.

Figure 7 shows the results.

Figure 7



Draw a ring around the anomalous result in **Figure 7**.

[1 mark]

0 3 . 6 The student did the experiment using 0.60 g of magnesium four times.

Table 4 shows the results.

Table 4

	Test 1	Test 2	Test 3	Test 4	Mean
Mass of the contents of the crucible after heating in grams	0.96	0.93	0.92	0.95	**X**

Calculate mean value **X**.

[2 marks]

Mean value **X** = _____ g

0 3 . 7 The student used a Bunsen burner instead of a water bath to heat the crucible.

Why did the student use a Bunsen burner?

[1 mark]

Tick (✓) **one** box.

A Bunsen burner heats up the crucible more slowly. ☐

A water bath is not hot enough. ☐

The crucible would dissolve in a water bath. ☐

Question 3 continues on the next page

5.3.1.3 Mass changes when a reactant or product is a gas

Question 03 · continued

0 3 . 8 A different student did the investigation.

The student heated the crucible for 1 minute instead of for 5 minutes.

The student obtained different results.

Suggest **one** reason why the student obtained different results.

[1 mark]

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