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	**Higher**
Question groups	**4**
Available paper years	**2020–2025**

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

November 2020 | 8464/C/2H | Original Q3

0 3 This question is about pollutants.

0 3 . 1 Waste water has harmful substances removed before being released into the environment.

Complete the sentences.

[2 marks]

Agricultural waste water requires the removal of harmful

_____ .

Industrial waste water may require the removal of harmful

_____ .

0 3 . 2 How is sewage sludge treated before being released into the environment?

[1 mark]

Tick (✓) **one** box.

- Aerobic biological treatment ☐
- Anaerobic digestion ☐
- Grit removal ☐
- Screening ☐

5.3.1.3 Mass changes when a reactant or product is a gas

Question 01 · continued

0 3 . 3 Hydrocarbons are used to make polymers. Polymers are used to make plastic bags.

In one year 8.0 billion plastic bags were used.

The next year there was a charge for plastic bags and only 1.3 billion plastic bags were used.

Calculate the percentage decrease in the number of plastic bags used.

[3 marks]

Percentage decrease = _____ %

Question 3 continues on the next page

5.3.1.3 Mass changes when a reactant or product is a gas

Oxides of nitrogen are pollutants formed in car engines.

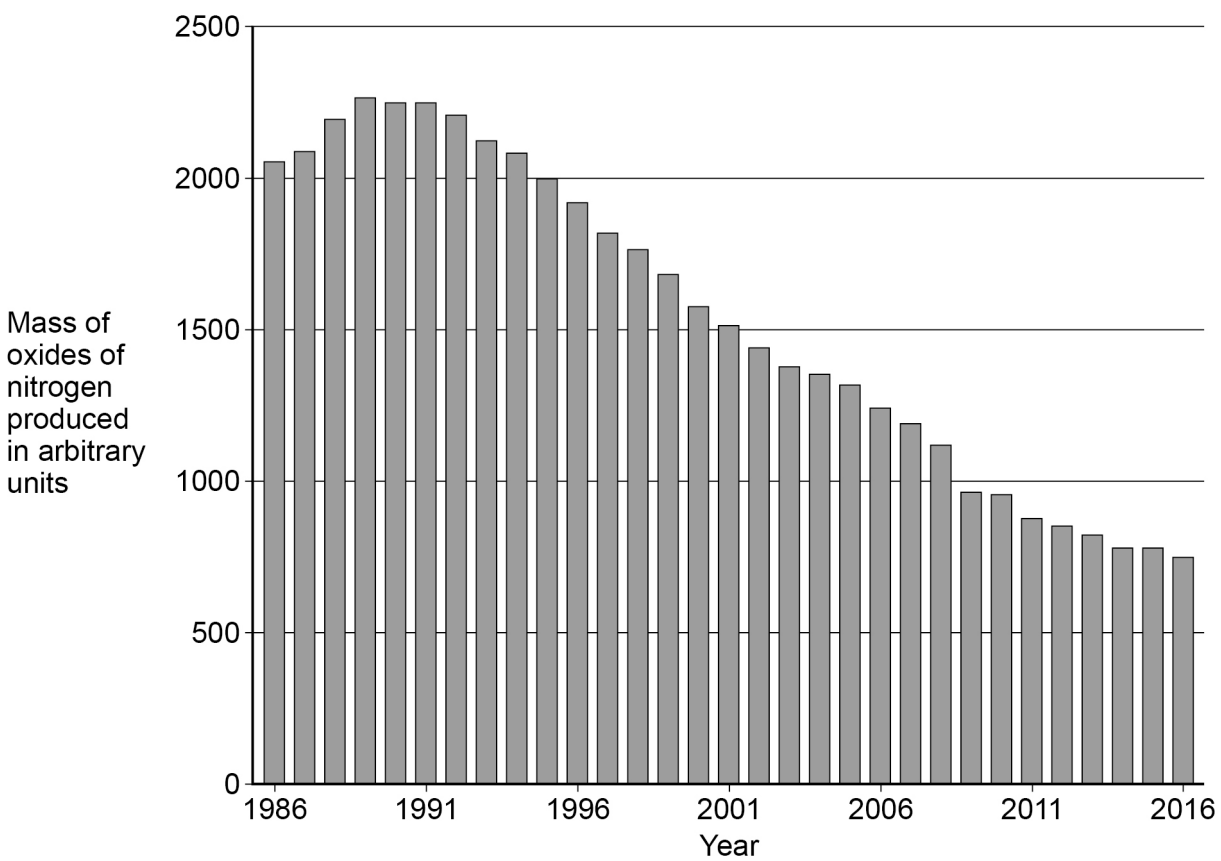
0 3 . 4 Give **one** problem oxides of nitrogen cause.

[1 mark]

_____

0 3 . 5 **Figure 3** shows the mass of oxides of nitrogen produced from car engines from 1986 to 2016.

Figure 3



Suggest why the mass of oxides of nitrogen produced from car engines increased and then decreased.

[2 marks]

Increased _____

_____

Decreased _____

_____

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5.3.1.3 Mass changes when a reactant or product is a gas

Question 02

November 2020 | 8464/C/2H | Original Q6

0 6 This question is about the Earth's atmosphere.

0 6 . 1 Carbon dioxide is a greenhouse gas.

The greenhouse effect happens in four stages.

The four stages are:

Stage **A** Carbon dioxide stops longer wavelength radiation escaping

Stage **B** Radiation is absorbed by the Earth

Stage **C** Longer wavelength radiation is emitted

Stage **D** Shorter wavelength radiation enters the atmosphere

What is the correct order of stages **A**, **B**, **C** and **D**?

[1 mark]

Tick (✓) **one** box.

C, **A**, **B**, **D** ☐

C, **D**, **B**, **A** ☐

D, **B**, **C**, **A** ☐

D, **C**, **B**, **A** ☐

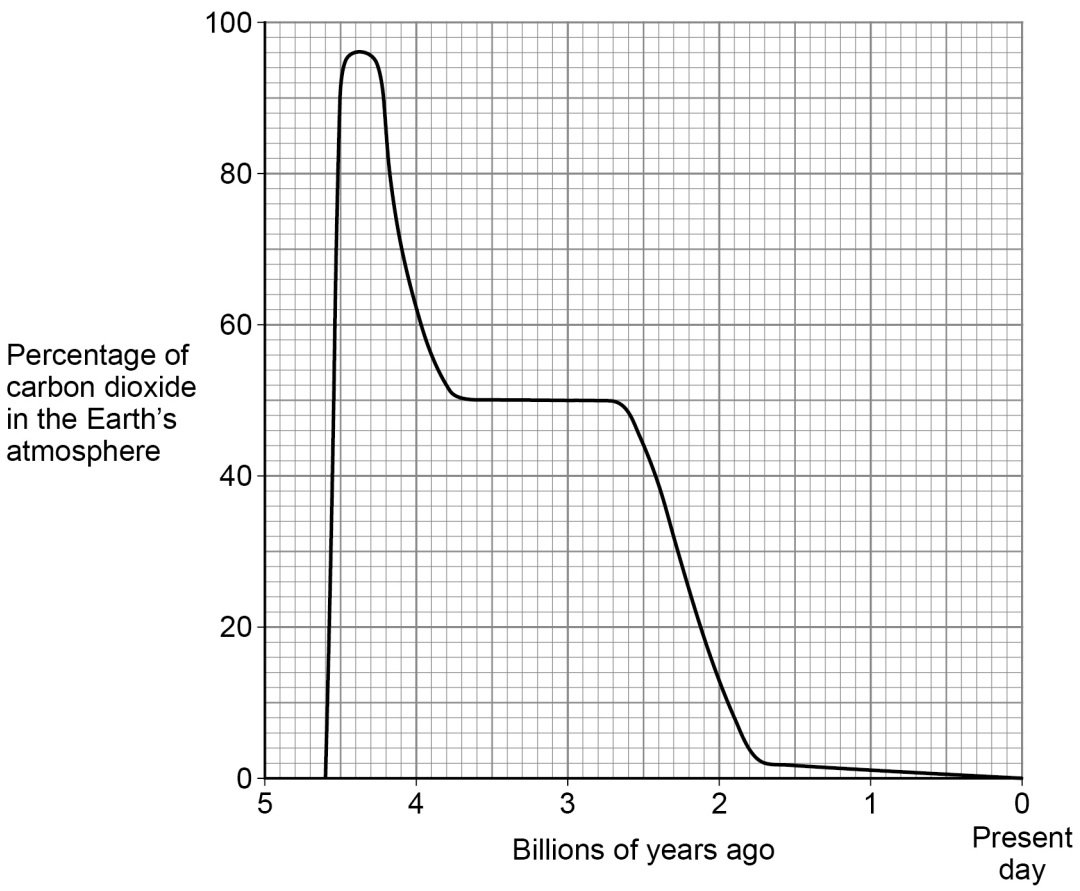
Question 6 continues on the next page

5.3.1.3 Mass changes when a reactant or product is a gas

Question 02 · continued

Figure 6 shows how the percentage of carbon dioxide in the Earth's atmosphere has changed over 4.6 billion years.

Figure 6



0 6 . 2 The mass of gas in Earth's atmosphere remains constant at 5.15×10^{18} kg

Determine the maximum mass of carbon dioxide that was in the Earth's atmosphere.

Use **Figure 6**.

[3 marks]

Mass of carbon dioxide = _____ kg

5.3.1.3 Mass changes when a reactant or product is a gas

Question 02 · continued

0 6 . 3 Describe the processes that have caused the main **changes** in the percentage of carbon dioxide in the Earth's atmosphere over the last 4.6 billion years.

Use **Figure 6**.

[6 marks]

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5.3.1.3 Mass changes when a reactant or product is a gas

Question 03

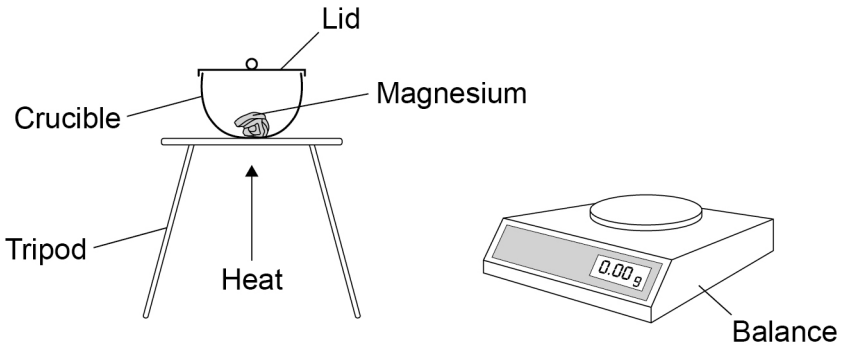
November 2021 | 8464/C/1H | Original Q6

0 6 Metal oxides are produced when metals are heated in air.

A student investigated the change in mass when 0.12 g of magnesium was heated in air.

Figure 5 shows the apparatus.

Figure 5



The student measured the mass of magnesium oxide produced.

0 6 . 1 0.12 g of magnesium reacted to produce 0.20 g of magnesium oxide.

Calculate the number of moles of oxygen gas (O_2) that reacted.

Relative atomic mass (A_r): O = 16

[3 marks]

Moles of oxygen gas = _____

5.3.1.3 Mass changes when a reactant or product is a gas

Question 03 · continued

0 6 . 2 The student repeated the experiment **without** a lid on the crucible.

Suggest why the mass of magnesium oxide produced would be different without a lid on the crucible.

[2 marks]

0 6 . 3 Copper reacts with oxygen to produce copper oxide.

63.5 g of copper produces 79.5 g of copper oxide.

Calculate the mass of copper oxide produced when 0.50 g of copper reacts with oxygen.

Give your answer to 3 significant figures.

[3 marks]

Mass (3 significant figures) = _____ g

Question 6 continues on the next page

5.3.1.3 Mass changes when a reactant or product is a gas

Question 03 · continued

0 6 . 4 Iron reacts with oxygen to produce an oxide of iron.

0.015 moles of iron reacts with 0.010 moles of oxygen gas (O_2).

Determine:

- the formula of the iron oxide produced
- the balanced symbol equation for the reaction.

[4 marks]

Formula of iron oxide = _____

Balanced symbol equation

_____

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5.3.1.3 Mass changes when a reactant or product is a gas

Question 04

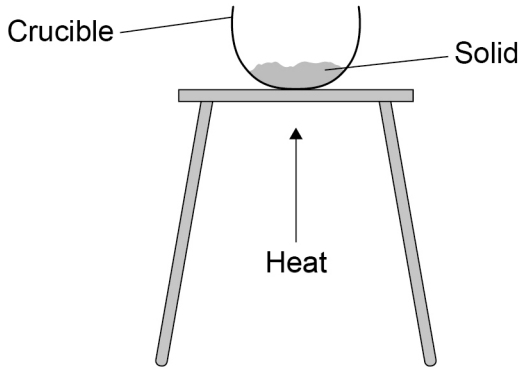
June 2025 | 8464/C/1H | Original Q6

0 6 Some reactions appear to involve a change in mass.

A student investigated the change in mass when solids were heated.

Figure 7 shows the apparatus.

Figure 7



The student determined the mass of the contents of the crucible at regular intervals.

0 6 . 1 The student used a Bunsen burner instead of a water bath to heat the crucible.

Suggest **one** reason why.

[1 mark]

Question 6 continues on the next page

Question 04 · continued

The student planned to heat:

- 0.01 mol of magnesium
- 0.01 mol of magnesium carbonate.

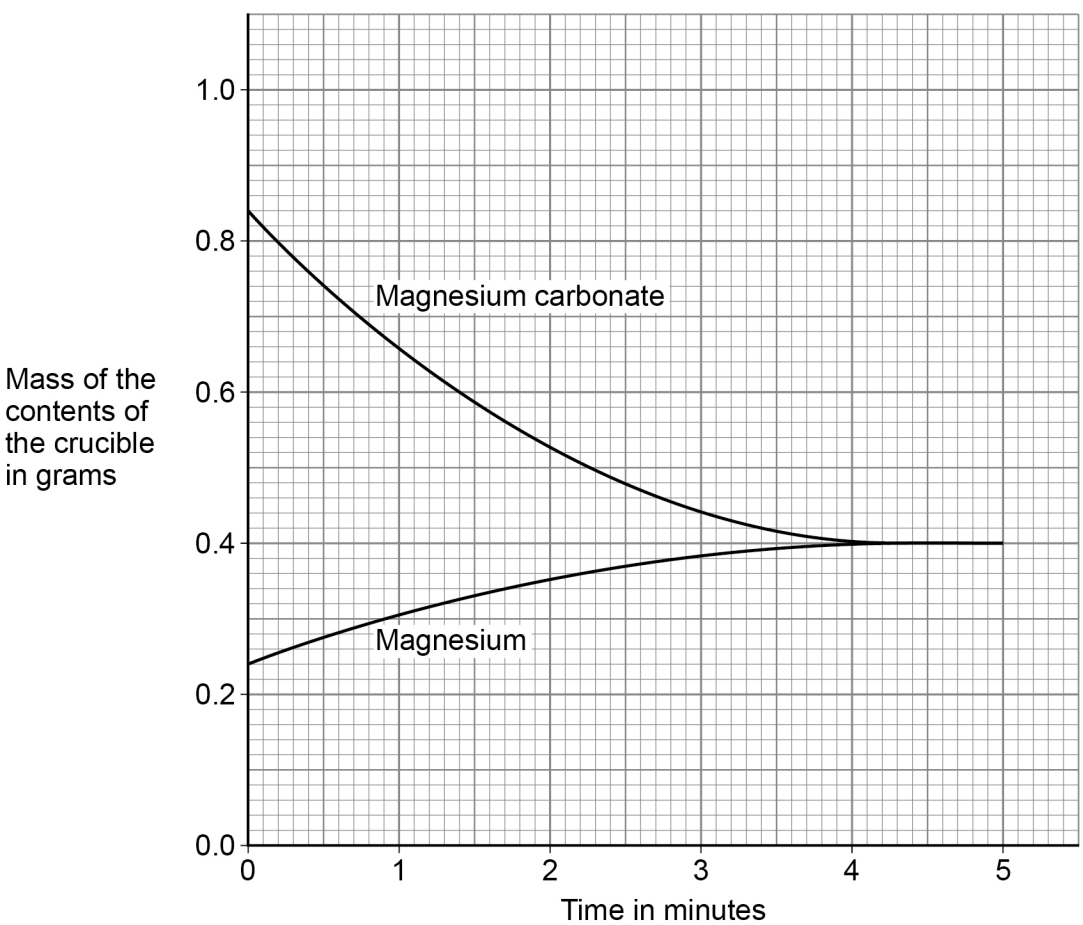
The equations for the reactions are:

$$Mg + \tfrac{1}{2}O_2 \rightarrow MgO$$

$$MgCO_3 \rightarrow MgO + CO_2$$

Figure 8 shows the student's **predicted** results.

Figure 8



5.3.1.3 Mass changes when a reactant or product is a gas

Question 04 · continued

0 6 . 2 Look at **Figure 8**.

Explain the **two** trends for the first 3 minutes.

[4 marks]

Magnesium _____

_____

_____

_____

Magnesium carbonate _____

_____

_____

_____

0 6 . 3 **Figure 8** shows that both reactions are complete after 5 minutes.

Why is the final mass of the contents of the crucible the same for both reactions?

[1 mark]

_____

_____

Question 6 continues on the next page

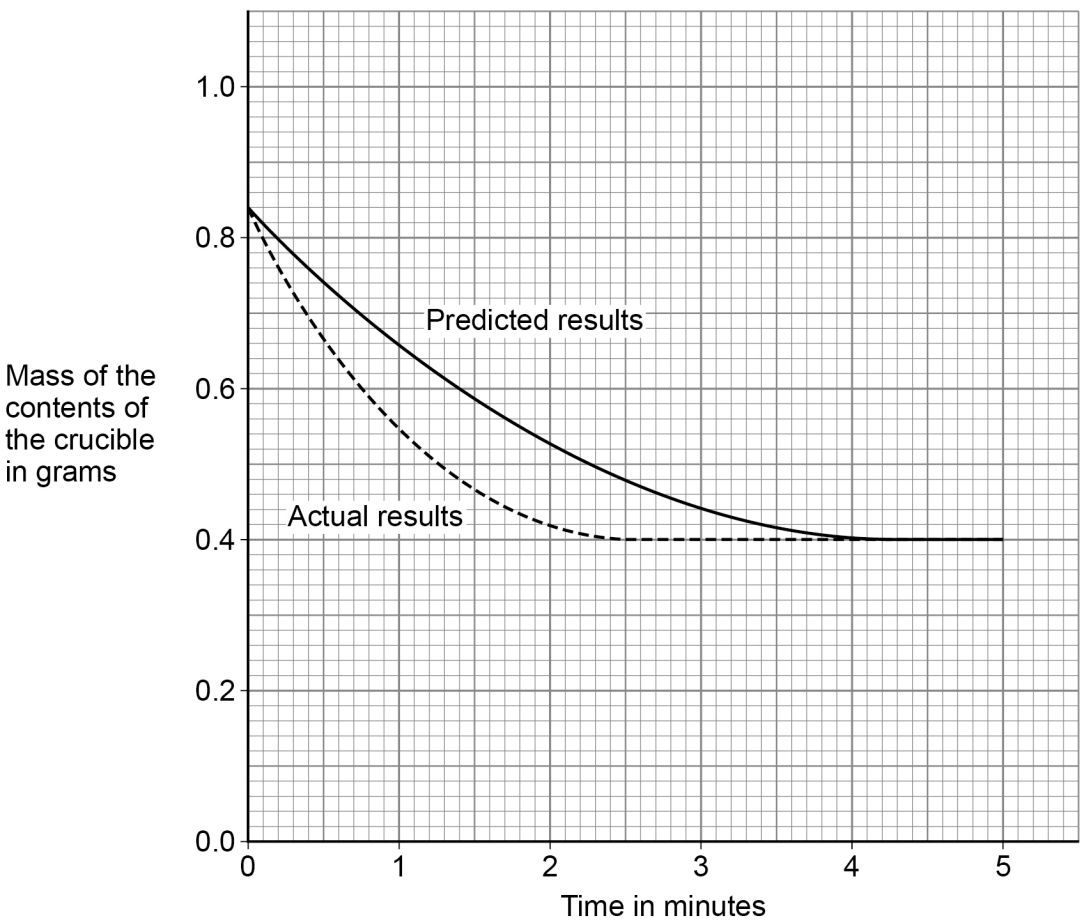
5.3.1.3 Mass changes when a reactant or product is a gas

Question 04 · continued

0 6 . 4 The student heated magnesium carbonate.

Figure 9 shows the results.

Figure 9



The student concluded:

'The difference between the predicted results and the actual results is caused by solid escaping from the crucible.'

Give **one** reason why the results show the student is **not** correct.

[1 mark]

5.3.1.3 Mass changes when a reactant or product is a gas

Question 04 · continued June 2025 | 8464/C/1H | Original Q6

0 6 . 5 Iron reacts with steam (H_2O) to produce an oxide of iron and hydrogen gas.

0.120 moles of iron reacts with 0.160 moles of steam.

Determine the balanced equation for the reaction.

You should determine:

- the simplest whole number mole ratio of Fe : H_2O
- the formula of the iron oxide produced.

[4 marks]

Simplest mole ratio of Fe : H_2O = _____ : _____

Formula of the iron oxide = _____

Balanced equation for the reaction:

_____ + _____ → _____ + _____

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