AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.3.1.3

Mass changes when a reactant or product is a gas

Past-paper questions

Tier	**Higher**
Question groups	**6**
Available paper years	**2009–2022**

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.

4.3.1.3 Mass changes when a reactant or product is a gas

Question 01

March 2009 | CHY1AP | Original Q7 | Legacy

QUESTION SEVEN

Calcium carbonate decomposes on heating to give calcium oxide and carbon dioxide.

$$CaCO_3 \rightarrow CaO + CO_2$$

100 g of calcium carbonate, on complete decomposition, produces 56 g of calcium oxide.

If the carbon dioxide is not allowed to escape, it will recombine with the calcium oxide. This can happen at any temperature.

The carbon dioxide formed could be:

- used by oil companies
- used by ice-cream companies
- reacted with sodium hydroxide to make sodium carbonate for glass-making.

7A Calculate the mass of carbon dioxide that would be released by completely decomposing 400 tonnes of calcium carbonate.

(1 tonne = 1 000 000 g)

1 17.6 tonnes

2 22.4 tonnes

3 176.0 tonnes

4 224.0 tonnes

7B If calcium oxide is left exposed to the air, it will increase in mass.

Which of the following could **not** be the reason for this?

1 The calcium oxide is recombining with carbon dioxide from the air.

2 The calcium oxide is reacting with water from the air.

3 The calcium oxide is still thermally decomposing.

4 The calcium oxide is reverting back to calcium carbonate.

4.3.1.3 Mass changes when a reactant or product is a gas

Question 01 · continued March 2009 | CHY1AP | Original Q7 | Legacy

7C A company makes calcium oxide from calcium carbonate.

The best way for this company to benefit economically, and at the same time reduce environmental damage, is to . . .

1 store the carbon dioxide in holes in the ground made by oil companies.

2 offer the carbon dioxide to oil companies so that they can use it to flush oil out of the ground.

3 sell solid carbon dioxide to ice-cream companies for keeping ice-cream cold.

4 sell the carbon dioxide to glass-making companies for conversion into sodium carbonate.

7D Graphs of global temperatures compared with the amount of carbon dioxide in the atmosphere over the past 50 years follow each other very closely.

The best conclusion that can be drawn from this is that . . .

1 burning fossil fuels causes global warming.

2 decomposing limestone causes global warming.

3 the heat from processing limestone causes global warming.

4 rising levels of carbon dioxide probably add to global warming.

4.3.1.3 Mass changes when a reactant or product is a gas

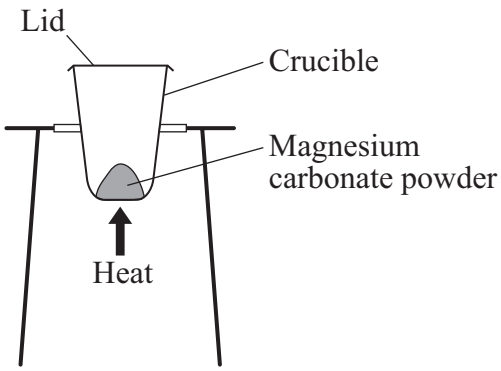
Question 02

June 2009 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

A student carried out an investigation using these instructions:

- weigh a crucible and lid
- put the sample of magnesium carbonate powder into the crucible
- weigh the crucible, lid and powder
- heat the crucible strongly
- allow to cool and weigh again
- repeat the heating, cooling and weighing until constant mass is achieved.



The student observed that the mass of the crucible and its contents decreased.

3A The substance remaining in the crucible after strong heating is . . .

1 magnesium.

2 magnesium oxide.

3 magnesium hydroxide.

4 carbon dioxide.

4.3.1.3 Mass changes when a reactant or product is a gas

Question 02 · continued June 2009 | CHY1AP | Original Q3 | Legacy

3B What caused the change in mass?

1 Some of the crucible burned away.

2 Water was given off.

3 Carbon dioxide was given off.

4 Some of the magnesium carbonate evaporated.

3C Why was the powder heated until constant mass was achieved?

1 to make sure that the magnesium carbonate had completely reacted

2 to make the test more reliable

3 to make sure that the balance was accurate

4 because the Bunsen burner was not hot enough

3D What type of reaction occurred in the crucible?

1 distillation

2 decomposition

3 combustion

4 evaporation

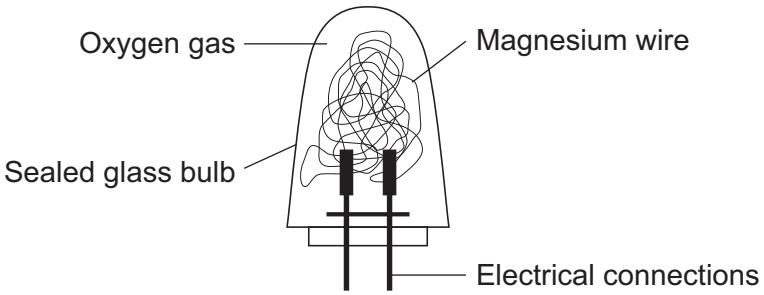
4.3.1.3 Mass changes when a reactant or product is a gas

Question 03

March 2011 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

The diagram shows a flash bulb that was used in photography.



When a photograph is taken, an electric current flows through the magnesium. The magnesium burns very brightly and very quickly. A white powder called magnesium oxide (MgO) is formed.

A student wanted to find out if the mass of the flash bulb changed when it was used.

- The mass of a new flash bulb was measured.
- It was made to flash and then allowed to cool.
- The glass bulb was unbroken.
- The mass of the used flash bulb was then measured.

3A Which of the following statements is correct?

The mass of the flash bulb . . .

1 did not change.

2 changed because a chemical reaction had taken place.

3 increased because a new substance had been made.

4 decreased because the magnesium and oxygen had been used up.

4.3.1.3 Mass changes when a reactant or product is a gas

Question 03 · continued

3B Which statement correctly describes what happens inside the flash bulb?

1 Magnesium and oxygen atoms make magnesium oxide when they mix together.

2 Magnesium and oxygen atoms combine and are held together by chemical bonds.

3 Many new magnesium and oxygen atoms are formed when there is a flash inside the flash bulb.

4 Magnesium and oxygen atoms combine to make atoms of magnesium oxide.

3C Which row in the table gives a correct description of each substance involved in the reaction in the flash bulb?

	Substance		
	Magnesium	**Oxygen**	**Magnesium oxide**
1	element	element	compound
2	element	compound	element
3	compound	compound	element
4	element	compound	compound

3D The magnesium oxide made in this reaction can be used to produce magnesium nitrate. The formula for magnesium nitrate is $Mg(NO_3)_2$

Which row in the table below shows the numbers of each type of atom in the formula $Mg(NO_3)_2$?

	Magnesium	**Nitrogen**	**Oxygen**
1	1	1	3
2	2	1	6
3	1	2	3
4	1	2	6

4.3.1.3 Mass changes when a reactant or product is a gas

Question 04

QUESTION SEVEN

Calcium carbonate decomposes on heating to give calcium oxide and carbon dioxide.

$$CaCO_3 \rightarrow CaO + CO_2$$

100 g of calcium carbonate, on complete decomposition, produces 44 g of carbon dioxide.

If the carbon dioxide is not allowed to escape, it will recombine with the calcium oxide. This can happen at any temperature.

7A Calculate the mass of calcium oxide that would be produced by completely decomposing 400 tonnes of calcium carbonate.

(1 tonne = 1 000 000 g)

1 17.6 tonnes

2 22.4 tonnes

3 176 tonnes

4 224 tonnes

7B If calcium oxide is left exposed to the air, it will increase in mass.

Which of the following could **not** be the reason for this?

1 The calcium oxide is recombining with carbon dioxide from the air.

2 The calcium oxide is reacting with water from the air.

3 The calcium oxide is still thermally decomposing.

4 The calcium oxide is changing back to calcium carbonate.

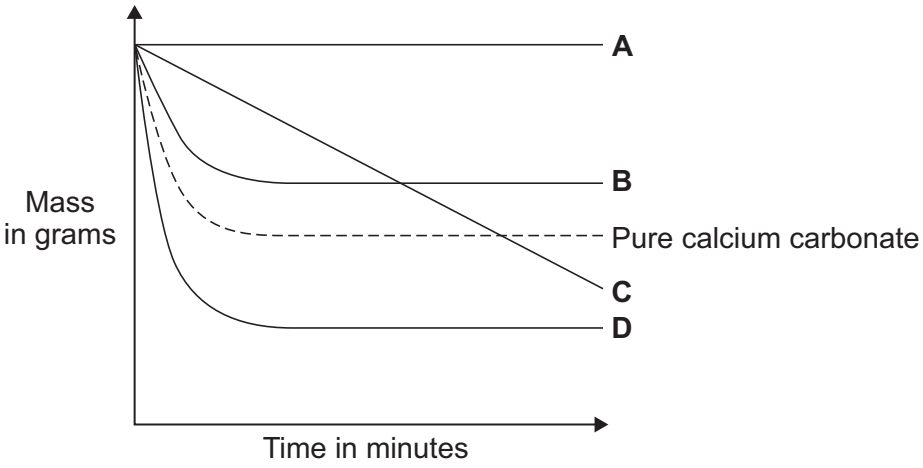
4.3.1.3 Mass changes when a reactant or product is a gas

Question 04 · continued

7C Limestone usually contains impurities.

The diagram below shows the change in mass when pure calcium carbonate is heated.

Which of the lines, **A**, **B**, **C** or **D,** shows a sample of limestone containing impurities that do not thermally decompose?



1 **A**

2 **B**

3 **C**

4 **D**

7D A company makes calcium oxide from calcium carbonate.

The best way for this company to benefit economically, **and** also to limit environmental damage, is to . . .

1 store the carbon dioxide in spaces underground which are left when coal has been extracted.

2 sell the carbon dioxide to oil companies so that they can use it to force oil out of the ground.

3 sell solid carbon dioxide to ice-cream companies for keeping ice-cream cold.

4 sell the carbon dioxide to companies that make fizzy drinks.

4.3.1.3 Mass changes when a reactant or product is a gas

Question 05

June 2014 | CH1HP | Original Q5 | Legacy

5 Limestone contains calcium carbonate ($CaCO_3$).

5 (a) Name the type of reaction that takes place when calcium carbonate is heated strongly.

Name the products formed.

[3 marks]

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5 (b) A student investigated what happens when limestone is heated strongly.

This is the method the student used:

- measure the mass of limestone before heating
- measure the mass of solid product after heating
- repeat the experiment three more times.

The student's results are shown in **Table 3**.

Table 3

	Experiment 1	Experiment 2	Experiment 3	Experiment 4
Mass of limestone before heating in g	5.0	5.0	5.0	5.0
Mass of solid product after heating in g	3.2	4.0	3.1	3.3
Mass lost in g	1.8	1.0	1.9	1.7

5 (b) (i) Calculate the mean mass lost, taking account of any anomalies.

[2 marks]

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Mean mass lost = ... g

4.3.1.3 Mass changes when a reactant or product is a gas

Question 05 · continued

5 (b) (ii) The student used the chemical equation to calculate the maximum mass lost by 5.0 g of calcium carbonate when heated.

The maximum mass lost is 2.2 g.

Suggest and explain **two** reasons why the mean mass lost in the experiments to heat limestone is less than 2.2 g.

Do **not** include any reference to weighing errors in your answer.

[4 marks]

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4.3.1.3 Mass changes when a reactant or product is a gas

Question 06

June 2022 | 8462/2H | Original Q2

0 2 A student investigated the change in mass when hydrated cobalt chloride was heated.

The word equation for the reaction is:

hydrated cobalt chloride ⇌ anhydrous cobalt chloride + water

This is the method used.

1. Add 2.0 g of hydrated cobalt chloride to an empty test tube.
2. Measure the mass of the test tube and contents.
3. Heat the test tube and contents gently for 30 seconds.
4. Allow the test tube and contents to cool.
5. Measure the mass of the test tube and contents.
6. Repeat steps 3 to 5 until the mass of the test tube and contents does not change.

Table 1 shows the results.

Table 1

Total heating time in seconds	Mass of test tube and contents in grams
0	26.5
30	26.2
60	25.9
90	25.6
120	25.6

4.3.1.3 Mass changes when a reactant or product is a gas

Question 06 · continued

0 2 . 1 Determine the mass of the empty test tube.

[1 mark]

Mass of empty test tube = _____ g

0 2 . 2 Explain why the mass of the test tube and contents decreased.

[2 marks]

0 2 . 3 Suggest why the test tube and contents were heated until the mass did not change.

[1 mark]

Question 2 continues on the next page

4.3.1.3 Mass changes when a reactant or product is a gas

Question 06 · continued

Energy is taken in from the surroundings when hydrated cobalt chloride is heated.

0 2 . 4 When 238 g of hydrated cobalt chloride is heated until the mass does not change, 88.1 kJ of energy is taken in.

The student heated 2.00 g of hydrated cobalt chloride until the mass did not change.

Calculate the energy taken in during this reaction.

Give your answer to 3 significant figures.

[3 marks]

Energy taken in (3 significant figures) = _____ kJ

0 2 . 5 What type of reaction takes place when hydrated cobalt chloride is heated?

[1 mark]

8