AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.3.1.3

Mass changes when a reactant or product is a gas

Past-paper questions

Tier	**Foundation**
Question groups	**9**
Available paper years	**2009–2025**

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.

4.3.1.3 Mass changes when a reactant or product is a gas

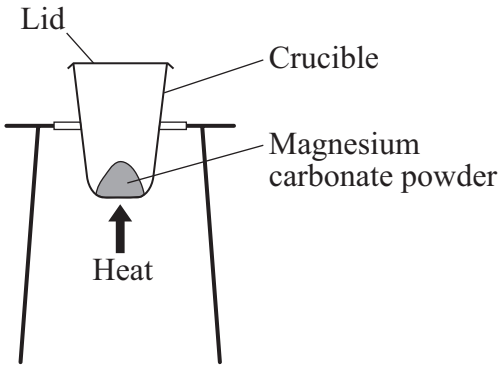
Question 01

June 2009 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

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.

8A The substance remaining in the crucible after strong heating is . . .

1 magnesium.

2 magnesium oxide.

3 magnesium hydroxide.

4 carbon dioxide.

8B 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.

4.3.1.3 Mass changes when a reactant or product is a gas

8C 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

8D What type of reaction occurred in the crucible?

1 distillation

2 decomposition

3 combustion

4 evaporation

Turn over for the next question

4.3.1.3 Mass changes when a reactant or product is a gas

Question 02

November 2010 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

Limestone is used for building. Acid rain can damage limestone buildings because limestone is mainly calcium carbonate. Calcium carbonate reacts with acid rain to produce carbon dioxide.

A scientist tests limestone with an acid rain solution to see how much damage occurs.

The scientist:

- weighed a piece of limestone
- put the limestone in the acid rain solution
- after 1 day, took the piece of limestone out of the solution and dried the surface
- reweighed the piece of limestone.

The scientist repeated this process with the same piece of limestone for 10 days.

The results are shown in the table.

Time in days	0	1	2	3	4	5	6	7	8	9	10
Mass in g	10.0	10.2	9.5	8.9	8.4	8.0	7.7	7.5	7.3	7.3	7.3

6A A gas that causes acid rain is . . .

1 carbon monoxide.

2 sulfur dioxide.

3 carbon dioxide.

4 nitrogen.

6B The mass of the piece of limestone increased during the first day because . . .

1 carbon dioxide was produced.

2 the acid was diluted with water.

3 the limestone soaked up some of the acid rain solution.

4 the substances were mixed.

4.3.1.3 Mass changes when a reactant or product is a gas

Question 02 · continued November 2010 | CHY1AP | Original Q6 | Legacy

6C The mass of the piece of limestone decreased during the 10 days because . . .

1 there was an error using the balance.

2 carbon dioxide was given off.

3 the acid rain had been absorbed.

4 all the calcium carbonate had reacted.

6D After 11 days, the mass of the piece of limestone would be . . .

1 10.0 g.

2 8.4 g.

3 7.3 g.

4 6.5 g.

Turn over for the next question

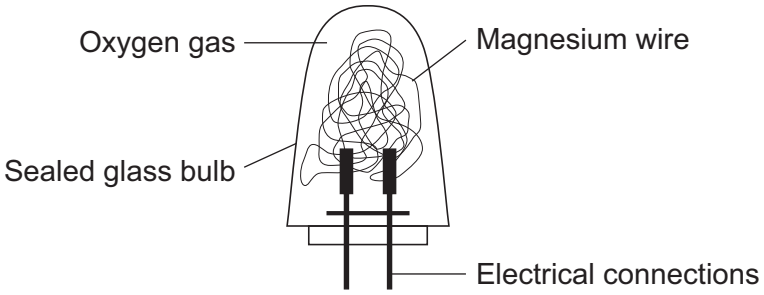
4.3.1.3 Mass changes when a reactant or product is a gas

Question 03

March 2011 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

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.

8A 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.

8B 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.

4.3.1.3 Mass changes when a reactant or product is a gas

Question 03 · continued

8C 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

8D 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

June 2014 | CH1FP | Original Q3 | Legacy

3 Limestone is used for statues and buildings.

Limestone contains calcium carbonate ($CaCO_3$).

3 (a) **Figure 2** shows a limestone quarry.

Figure 2



3 (a) (i) Suggest **one** problem quarrying limestone will cause for people living nearby.

[1 mark]

.....

.....

3 (a) (ii) Suggest **one** benefit of quarrying limestone for people living nearby.

[1 mark]

.....

.....

3 (a) (iii) Why are limestone statues and buildings damaged by rain?

[1 mark]

.....

.....

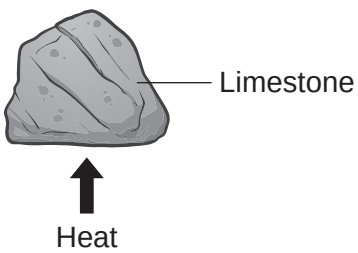
Question 3 continues on the next page

4.3.1.3 Mass changes when a reactant or product is a gas

Question 04 · continued

3 (b) A student investigated what happens when limestone is heated, as shown in **Figure 3**.

Figure 3



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 two more times.

The student's results are shown in **Table 2**.

Table 2

	Experiment 1	Experiment 2	Experiment 3
Mass of limestone before heating in g	5.0	5.0	5.0
Mass of solid product after heating in g	3.6	3.4	3.8
Mass lost in g	1.4	1.6	

3 (b) (i) Calculate the mass lost in experiment **3**.

[1 mark]

.....

.....

Mass lost = ... g

3 (b) (ii) Calculate the mean mass lost in the three experiments.

[1 mark]

.....

.....

Mean mass lost = ... g

4.3.1.3 Mass changes when a reactant or product is a gas

Question 04 · continued

3 (b) (iii) Suggest **one** reason why the mass lost was **not** the same for the three experiments.

[1 mark]

.....

.....

3 (c) The word equation for the reaction when calcium carbonate is heated is:

calcium carbonate ⟶ calcium oxide + carbon dioxide

3 (c) (i) Complete the sentence.

[1 mark]

The reaction when calcium carbonate is heated is called

thermal ..... .

3 (c) (ii) Heating 5.0 g of calcium carbonate produces 2.8 g of calcium oxide.

Calculate the mass of carbon dioxide produced.

[1 mark]

.....

.....

Mass of carbon dioxide = ... g

3 (c) (iii) Describe how to test a gas to show that it is carbon dioxide.

[2 marks]

Test .....

.....

Result .....

.....

10

4.3.1.3 Mass changes when a reactant or product is a gas

Question 05

June 2018 | 8462/1F | Original Q5

0 5 A student investigated the mass of copper oxide produced by heating copper carbonate.

This is the method used.

1. Weigh an empty test tube.
2. Weigh 2.00 g of copper carbonate into the test tube.
3. Heat the copper carbonate until there appears to be no further change.
4. Re-weigh the test tube and copper oxide produced.
5. Subtract the mass of the empty tube to find the mass of copper oxide.
6. Repeat steps 1–5 twice.
7. Repeat steps 1–6 with different masses of copper carbonate.

Table 4 shows the student's results.

Table 4

Mass of copper carbonate in g	Mass of copper oxide in g			
	Trial 1	Trial 2	Trial 3	Mean
2.00	1.29	1.27	1.31	1.29
4.00	2.89	2.57	2.59	2.58
6.00	3.85	3.90	3.87	3.87
8.00	5.12	5.15	5.09	**X**
10.00	6.42	6.45	6.45	6.44

The equation for the reaction is:

$$CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$$

0 5 . 1 Complete the sentence.

[1 mark]

The state symbol shows carbon dioxide is a _____.

4.3.1.3 Mass changes when a reactant or product is a gas

Question 05 · continued

0 5 . 2 Why do the contents of the test tube lose mass in the investigation?

[1 mark]

0 5 . 3 Calculate the mean mass **X** in **Table 4**.

[1 mark]

X = _____ g

0 5 . 4 One of the results in **Table 4** is anomalous.

Which result is anomalous?

[1 mark]

Mass of copper carbonate _____ g Trial _____

0 5 . 5 Suggest how the investigation could be improved to make sure the reaction is complete.

[2 marks]

Question 05 · continued

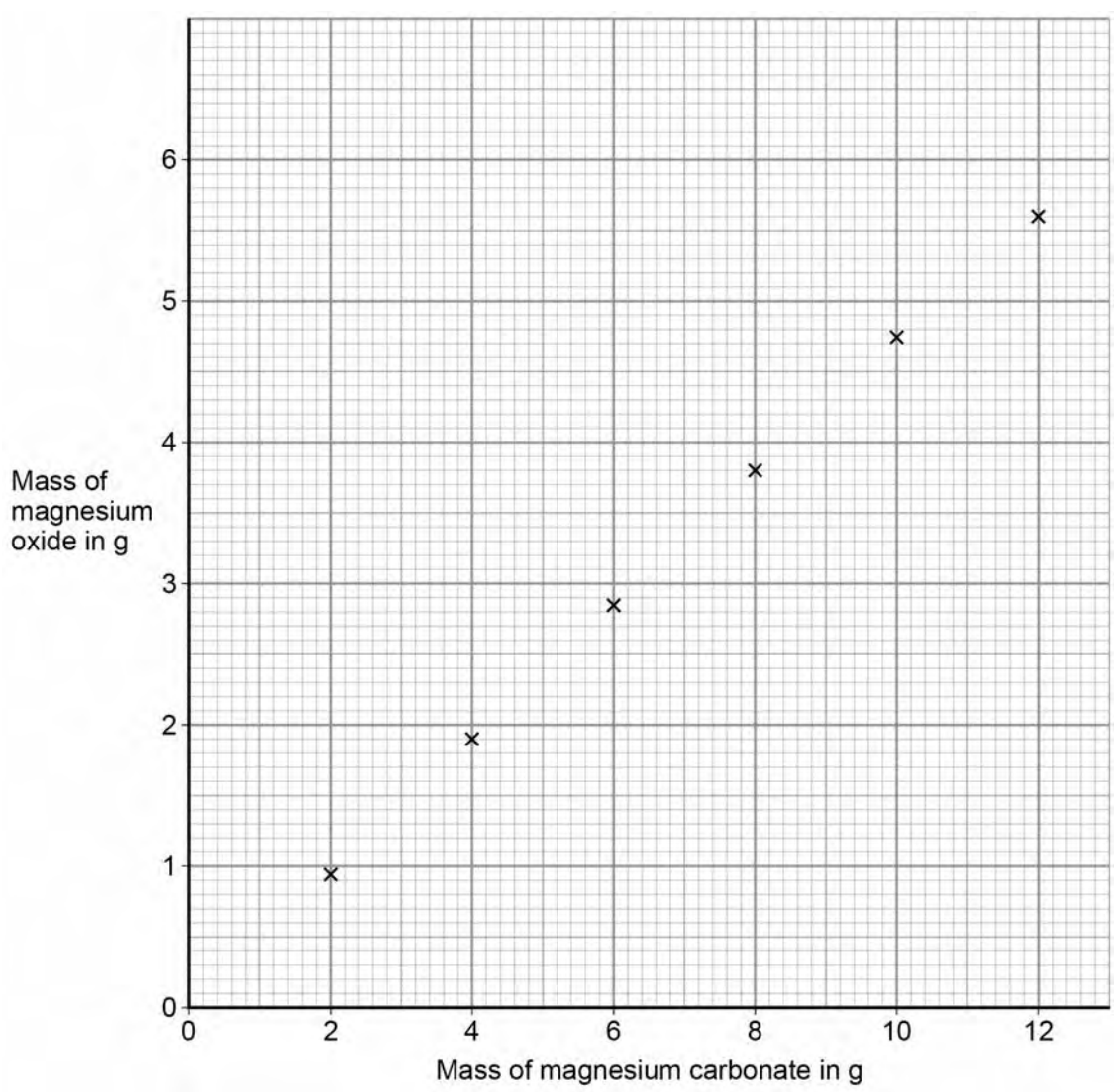
Another student repeated the investigation using magnesium carbonate instead of copper carbonate.

The word equation for the reaction is:

magnesium carbonate → magnesium oxide + carbon dioxide

Figure 8 shows the results of the investigation.

Figure 8



4.3.1.3 Mass changes when a reactant or product is a gas

Question 05 · continued

0 5 . 6 Draw a line of best fit on **Figure 8**.

[1 mark]

0 5 . 7 Determine the mass of magnesium oxide produced by 8.4 g of magnesium carbonate.

Use **Figure 8**.

[1 mark]

Mass = _____ g

0 5 . 8 Calculate the mass of magnesium oxide produced when 168 g of magnesium carbonate is heated.

Use your answer to Question **05.7**

[2 marks]

_____

_____

_____

_____

Mass of magnesium oxide produced = _____ g

4.3.1.3 Mass changes when a reactant or product is a gas

Question 06

June 2022 | 8462/2F | Original Q9

0 9 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 9 shows the results.

Table 9

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 9 . 1 Determine the mass of the empty test tube.

[1 mark]

Mass of empty test tube = _____ g

0 9 . 2 Explain why the mass of the test tube and contents decreased.

[2 marks]

0 9 . 3 Suggest why the test tube and contents were heated until the mass did not change.

[1 mark]

Question 9 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 9 . 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 9 . 5 What type of reaction takes place when hydrated cobalt chloride is heated?

[1 mark]

8

4.3.1.3 Mass changes when a reactant or product is a gas

Question 07

June 2023 | 8462/2F | Original Q5

0 5 This question is about greenhouse gases and climate change.

0 5 . 1 Which **two** gases are greenhouse gases?

[2 marks]

Tick (✓) **two** boxes.

- Argon ☐
- Carbon dioxide ☐
- Nitrogen ☐
- Methane ☐
- Oxygen ☐

0 5 . 2 Why are greenhouse gases essential for supporting life on Earth?

[1 mark]

_____

_____

The percentage of greenhouse gases in the Earth's atmosphere today is increasing.

Many scientists think that this increase is causing global climate change.

0 5 . 3 What is a cause of the greenhouse effect?

Complete the sentence.

[1 mark]

Greenhouse gases absorb long wavelength _____.

4.3.1.3 Mass changes when a reactant or product is a gas

Question 07 · continued

0 5 . 4 Which **two** are potential effects of global climate change?

[2 marks]

Tick (✓) **two** boxes.

- Fewer droughts ☐
- Fewer storms ☐
- Higher sea levels ☐
- Less coastal flooding ☐
- Melting polar ice ☐

0 5 . 5 Water vapour is a greenhouse gas.

The percentage by mass of water vapour in the Earth's atmosphere is 0.25%.

Calculate the mass of water vapour in 350 kg of the Earth's atmosphere.

Give your answer in grams.

[3 marks]

Mass = _____ g

9

4.3.1.3 Mass changes when a reactant or product is a gas

Question 08

0 2 This question is about burning coal.

A power station has four coal-burning furnaces.

Each furnace burns 3000 kg of coal per minute.

Table 1 shows some information about this coal burning power station

Table 1

Number of furnaces in use	Mass of coal burned per minute in kilograms	Mass of sulfur dioxide produced per minute in kilograms	Mass of carbon dioxide produced per minute in kilograms
0	0	0	0
1	3000	100	7000
2	6000	200	14 000
3	9000	300	21 000
4	12 000	400	28 000

0 2 . 1 Carbon dioxide is a greenhouse gas.

What is the effect on the rate of global climate change of using more furnaces in this power station?

Complete the sentence.

Choose the answer from the box.

[1 mark]

decreases	**stays the same**	**increases**

Use **Table 1**.

The rate of global climate change _____.

4.3.1.3 Mass changes when a reactant or product is a gas

Question 08 · continued

0 2 . 2 7000 kg of carbon dioxide are produced when 3000 kg of coal are burned.

Calculate the mass of carbon dioxide produced when 1 kilogram of coal is burned.

[2 marks]

Mass of carbon dioxide = _____ kg

0 2 . 3 Complete the sentence.

[1 mark]

Sulfur dioxide causes an environmental effect called acid _____ .

Question 2 continues on the next page

Question 08 · continued

Table 1 is repeated below.

Table 1

Number of furnaces in use	Mass of coal burned per minute in kilograms	Mass of sulfur dioxide produced per minute in kilograms	Mass of carbon dioxide produced per minute in kilograms
0	0	0	0
1	3000	100	7000
2	6000	200	14 000
3	9000	300	21 000
4	12 000	400	28 000

0 2 . 4 **Figure 3** shows how the mass of sulfur dioxide produced per minute varies with the mass of coal burned per minute.

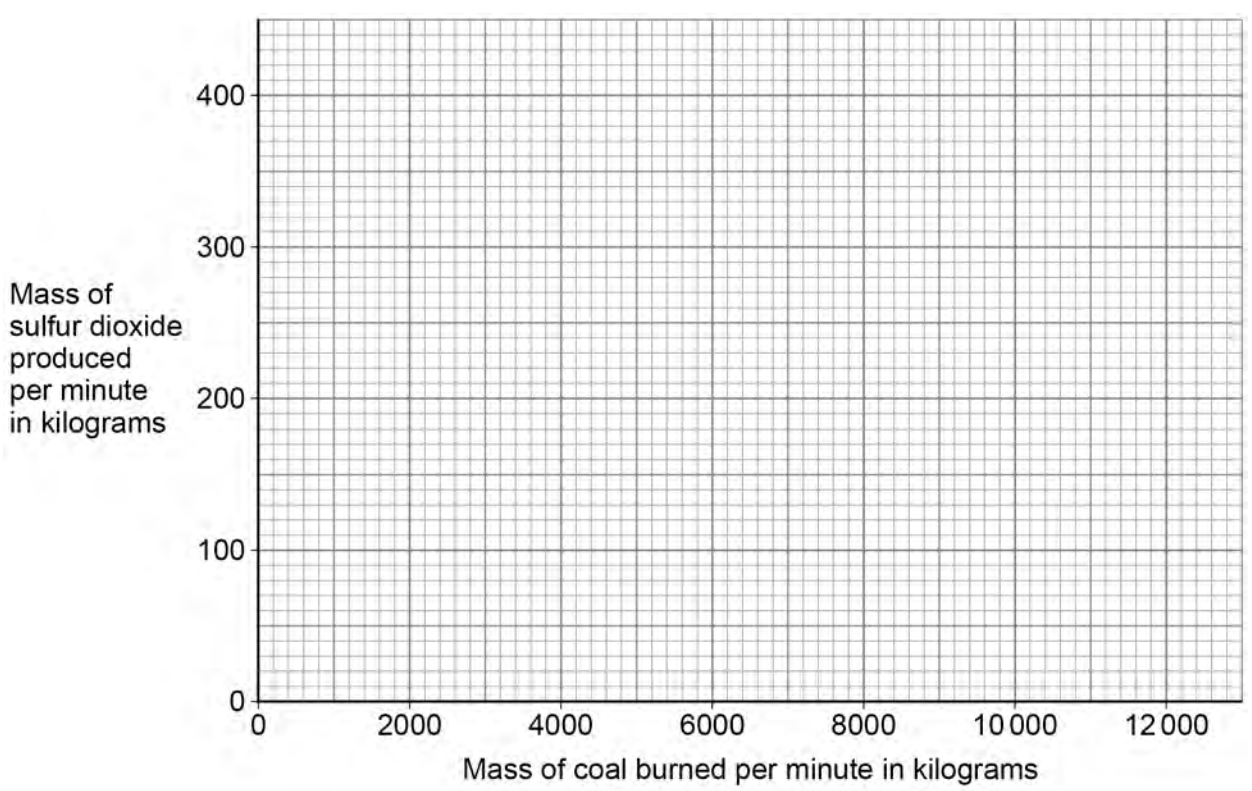
Complete **Figure 3**.

You should:

- plot data from **Table 1** on **Figure 3**
- draw a line of best fit.

[3 marks]

Figure 3



4.3.1.3 Mass changes when a reactant or product is a gas

Question 08 · continued

0 2 . 5 Complete the sentence.

Use **Table 1** and **Figure 3**.

[1 mark]

As the mass of coal burned per minute increases, the mass of sulfur dioxide produced per minute _____ .

0 2 . 6 This power station also releases particulates into the air.

Complete the sentence.

[1 mark]

The release of particulates into the air causes global _____ .

9

Turn over for the next question

4.3.1.3 Mass changes when a reactant or product is a gas

Question 09

June 2025 | 8462/1F | Original Q2

0 2 Metals react with acids to produce a salt and a gas.

0 2 . 1 Which salt is produced when magnesium reacts with hydrochloric acid?

[1 mark]

Tick (✓) **one** box.

- Magnesium chloride ☐
- Magnesium nitrate ☐
- Magnesium sulfate ☐

0 2 . 2 Which gas is produced when magnesium reacts with hydrochloric acid?

[1 mark]

Tick (✓) **one** box.

- Carbon dioxide ☐
- Chlorine ☐
- Hydrogen ☐
- Oxygen ☐

Question 2 continues on the next page

Question 09 · continued

A student investigated the temperature change in the reaction between metals and hydrochloric acid.

This is the method used.

1. Measure 25 cm^3 of hydrochloric acid at 20 °C into a container.

2. Add 1 g of a metal.

3. Record the temperature change.

4. Repeat steps 1 to 3 using a different metal.

0 2 . 3 Draw **one** line from the type of variable to the name of the variable in the investigation.

[2 marks]

Type of variable	Name of variable
	Mass of metal
Dependent variable	Temperature change
Independent variable	Type of metal
	Volume of hydrochloric acid

4.3.1.3 Mass changes when a reactant or product is a gas

Question 09 · continued

0 2 . 4 Which container would be the most suitable to reduce energy transfer with the surroundings?

[1 mark]

Tick (✓) **one** box.

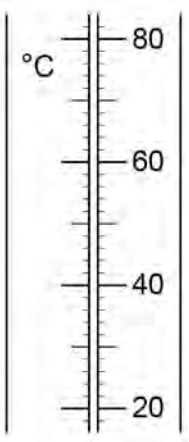
A copper can ☐

A glass beaker ☐

A polystyrene cup ☐

0 2 . 5 **Figure 1** shows part of the scale of the thermometer used in the investigation.

Figure 1



What is the resolution of the thermometer?

[1 mark]

Tick (✓) **one** box.

1 °C ☐ 2 °C ☐ 10 °C ☐ 20 °C ☐

4.3.1.3 Mass changes when a reactant or product is a gas

Question 09 · continued

0 2 . 6 The reaction between a metal and an acid is exothermic.

What happens to the temperature of the mixture during the reaction?

[1 mark]

Tick (✓) **one** box.

Decreases ☐

Stays the same ☐

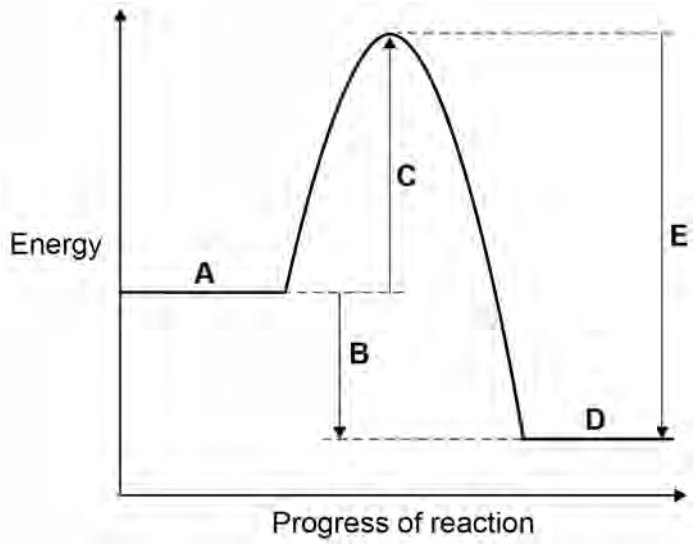
Increases ☐

4.3.1.3 Mass changes when a reactant or product is a gas

Question 09 · continued

Figure 2 shows the reaction profile for the reaction between a metal and an acid.

Figure 2



0 2 . 7 Which letter in **Figure 2** represents the reactants?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 2 . 8 Which letter in **Figure 2** represents the activation energy?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 2 . 9 Which letter in **Figure 2** represents the overall energy change?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

10