AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.8.3.3

# Carbonates

## Past-paper questions

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **23** |
| Available paper years | **2007–2024** |

## 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.

4.8.3.3 Carbonates

Question 01

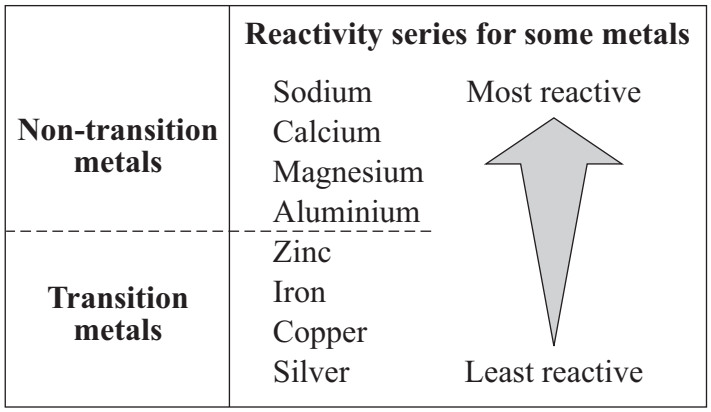
June 2007 | CHY1A | Original Q7 | Legacy

## QUESTION SEVEN

The table shows what happens to some metal carbonates when they are heated in a Bunsen burner flame.

| Name of carbonate | What happens when heated |
|---|---|
| Sodium carbonate | melts at 851°C but decomposes only at much higher temperatures |
| Calcium carbonate | decomposes at 825 °C |
| Magnesium carbonate | decomposes at 350 °C |
| Zinc carbonate | decomposes at 300 °C |
| Silver carbonate | decomposes at 220 °C |

The information below may help you to answer some parts of this question.




**7A** What pattern, if any, can be seen in these results for the action of heat on metal carbonates?

**1** All metal carbonates decompose when they are heated in a Bunsen burner flame.

**2** Carbonates of the more reactive metals decompose at higher temperatures.

**3** Carbonates of the transition metals decompose at higher temperatures.

**4** There is no pattern to the results.

**4.8.3.3 Carbonates**

**Question 01 · continued** June 2007 | CHY1A | Original Q7 | Legacy

**7B** Potassium carbonate melts at 891°C but does not decompose.

What is the probable position of potassium in the reactivity series?

**1** below silver

**2** between silver and copper

**3** between calcium and sodium

**4** above sodium

**7C** What is produced by all metal carbonates when they decompose?

**1** oxygen

**2** hydrogen

**3** a metal oxide

**4** a hydrocarbon

**7D** 3.10 grams of copper carbonate are heated in a test tube until completely decomposed.
1.10 grams of carbon dioxide are collected and a black compound is left in the test tube.

What is the mass of the black compound?

**1** 1.10 grams

**2** 2.00 grams

**3** 3.41 grams

**4** 4.20 grams

4.8.3.3 Carbonates

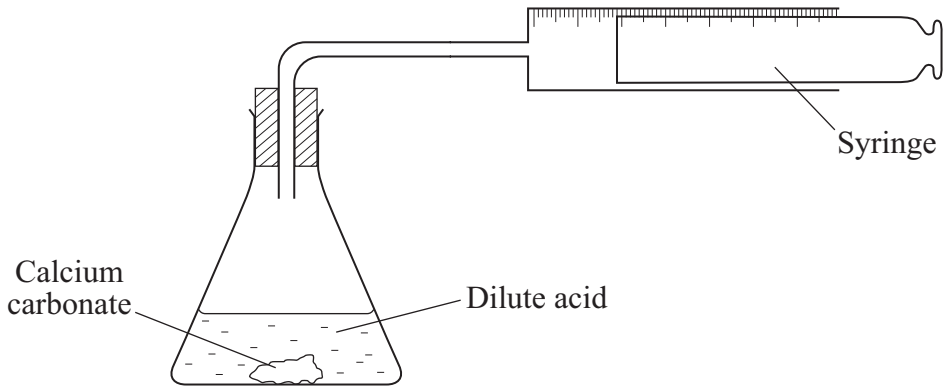
Question 02

November 2007 | CHY1A | Original Q7 | Legacy

## QUESTION SEVEN

Calcium carbonate reacts with acids to produce carbon dioxide gas.

A student investigated the reaction when a 10 g piece of calcium carbonate reacted with a dilute acid in this apparatus.




The student recorded the total volume of carbon dioxide collected in the syringe every two minutes.

When the reaction finished, there was still some unreacted calcium carbonate left in the conical flask.

**Results**

| **Time in minutes** | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total volume of carbon dioxide in $cm^3$** | 0 | 40.1 | 55.6 | 66.4 | 74.5 | 80.7 | 82.2 | 82.5 | 82.5 | 82.5 |

**4.8.3.3 Carbonates**

**Question 02 · continued**



**7A** The reaction finishes just before . . .

**1** 12 minutes.

**2** 14 minutes.

**3** 16 minutes.

**4** 18 minutes.

**7B** To find a more accurate time for the end of the reaction, the student could . . .

**1** use a larger volume of acid.

**2** use a larger piece of calcium carbonate.

**3** measure the volume of the carbon dioxide every 30 seconds.

**4** use a digital clock.

**7C** To improve the reliability of the data, the student should . . .

**1** take readings for more than 18 minutes.

**2** use a more accurate syringe.

**3** measure the strength of the acid.

**4** repeat the investigation at least one more time.

**7D** These results are best displayed as a . . .

**1** line graph.

**2** bar chart.

**3** scattergram.

**4** table.

**4.8.3.3 Carbonates**

**Question 03**

January 2008 | CHY1F | Original Q8 | Legacy

**8** Soda-lime glass is made by heating, to above 1500 °C, a mixture of:

soda (sodium carbonate), $Na_2CO_3$

limestone (calcium carbonate), $CaCO_3$

sand (silicon dioxide), $SiO_2$

(a) (i) Which element do all of these compounds contain?

.....

*(1 mark)*

(ii) Explain what the formula $Na_2CO_3$ shows about the compound.

.....

.....

.....

.....

*(2 marks)*

(b) Calcium carbonate breaks down when heated to above 1500 °C.

(i) Write a word equation to show what happens.

..... → ..... + .....

*(2 marks)*

(ii) What is the name of this type of chemical reaction?

.....

*(1 mark)*

(c) The melting point of soda-lime glass is about 750 °C.
The raw materials for making soda are limestone and common salt (sodium chloride).
There are almost unlimited amounts of the raw materials available to manufacture soda-lime glass.

From the information given, what is the most important reason for recycling soda-lime glass?

.....

.....

*(1 mark)*

7

**4.8.3.3 Carbonates**

**Question 04**

January 2008 | CHY3F | Original Q2 | Legacy

**2** A bottle of washing soda was found in a school laboratory. The modern name of washing soda is sodium carbonate.




A student tested the washing soda to prove that it was sodium carbonate.

(a) The student did a flame test to show that washing soda is a sodium compound.

The student used a clean wire to put the washing soda into the flame.

(i) Why should the wire be clean when used for a flame test?

.....

*(1 mark)*

(ii) The table shows some properties of metals.

**Two** of these are properties that the wire must have if it is used for a flame test.

Put a tick (✓) next to the **two** correct properties.

| Property | (✓) |
|---|---|
| Good electrical conductor | |
| High density | |
| High melting point | |
| Low boiling point | |
| Unreactive | |

*(2 marks)*

**4.8.3.3 Carbonates**

**Question 04 · continued**



*BLANK*

(iii) Which **one** of the following flame colours shows that washing soda is a sodium compound?

Draw a ring around your answer.

**brick-red** **lilac** **yellow-orange**

*(1 mark)*

(b) The student used dilute hydrochloric acid to show that washing soda was a carbonate. Carbon dioxide gas was given off.

(i) Describe what you **see** happening when a gas is given off.

.....

.....

*(1 mark)*

(ii) The student used limewater to prove that the gas given off was carbon dioxide.

Complete this sentence by choosing the correct word from the box.

| **clear** | **colourless** | **milky** |
|---|---|---|

When carbon dioxide reacts with limewater, the limewater turns

..... .

*(1 mark)*

(c) Instrumental methods are used to identify chemicals.

Describe some advantages of instrumental methods compared with chemical tests by considering:

- the length of time needed to carry out a test
- the amount of chemical used.

.....

.....

.....

.....

.....

*(2 marks)*

**8**

4.8.3.3 Carbonates

Question 05

June 2008 | CHY1AP | Original Q1 | Legacy

## QUESTION ONE

This question is about limestone.

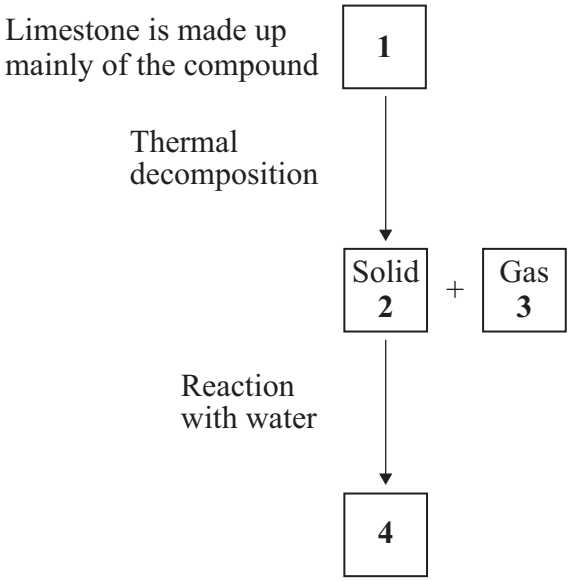
Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

**A** calcium carbonate

**B** carbon dioxide

**C** calcium oxide

**D** slaked lime



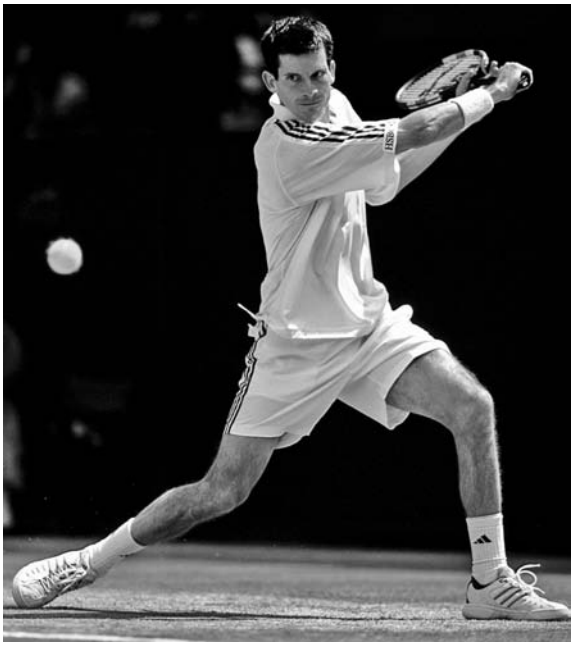
**4.8.3.3 Carbonates**

**Question 06**

June 2008 | CHY3F | Original Q3 | Legacy

**3** The information in the box was on the internet.

**Breathtaking Finish**



Tim Henman used *smelling salts* to help revive his fortunes at Wimbledon yesterday.

The active chemical in *smelling salts* is ammonium carbonate, $(NH_4)_2CO_3$.

A student tested some *smelling salts* to prove that they contained ammonium ions and carbonate ions.

**3** (a) Complete these sentences by choosing the correct substances from the box.

**3** (a) (i) Test for carbonate ions.

| | | |
|---|---|---|
| **ammonia** | **carbon dioxide** | **hydrochloric acid** |
| **limewater** | **water** | |

The student added ..... to the smelling salts.

A gas called ..... was given off.

This gas turned ..... milky.

*(3 marks)*

**4.8.3.3 Carbonates**

**Question 06 · continued**



*for mark*

**3** (a) (ii) Test for ammonium ions.

| | | |
|---|---|---|
| **ammonia** | **carbon dioxide** | **hydrochloric acid** |
| **litmus** | **sodium hydroxide** | |

The student added ..... to the smelling salts.

A gas called ..... was given off.

This gas turned ..... paper blue.

*(3 marks)*

**3** (b) Suggest why ammonium ions **cannot** be identified using a flame test.

.....

.....

*(1 mark)*

7

4.8.3.3 Carbonates

Question 07

March 2009 | CHY1AP | Original Q7 | Legacy

## QUESTION SEVEN

A student designed an experiment to find the mass of calcium oxide that could be obtained from 5.00 g of calcium carbonate.

He heated 5.00 g of calcium carbonate in a test tube with a Bunsen burner. The mass of the contents remaining in the test tube was recorded every minute.

He repeated the experiment with another 5.00 g of calcium carbonate.

The results are shown in the table.

| | Time in minutes | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| **Mass of the contents of the test tube in g** | Test 1 | 5.00 | 4.81 | 4.23 | 3.85 | 3.43 | 3.08 | 2.96 |
| | Test 2 | 5.00 | 4.55 | 3.97 | 3.36 | 2.92 | 2.80 | 2.80 |

**7A** To improve the reliability of the results, the student should . . .

**1** use a more precise balance.

**2** repeat the investigation at least one more time.

**3** use a greater mass of calcium carbonate.

**4** measure the mass of carbon dioxide released during heating.

**7B** One variable that is difficult to control in this experiment is . . .

**1** the mass of the calcium carbonate.

**2** the mass of the test tube.

**3** the time for which the calcium carbonate is heated.

**4** the temperature of the Bunsen burner flame.

**4.8.3.3 Carbonates**

**Question 07 · continued** March 2009 | CHY1AP | Original Q7 | Legacy

**7C** The student wants an accurate result for the mass of calcium oxide that forms from 5.00 g of calcium carbonate.

He should . . .

**1** take readings at shorter time intervals.

**2** remove the calcium oxide from the tube to find the mass.

**3** use a larger test tube so that the carbon dioxide given off does not escape.

**4** heat the calcium carbonate until there is no further loss in mass.

**7D** This is the word equation for the decomposition of calcium carbonate:

$$\text{calcium carbonate} \rightarrow \text{calcium oxide} + \text{carbon dioxide}$$

When 5.00 g of calcium carbonate is heated, 2.80 g of calcium oxide is left.

How much carbon dioxide has been given off?

**1** 2.20 g

**2** 2.80 g

**3** 5.00 g

**4** 7.80 g

4.8.3.3 Carbonates

Question 08

June 2009 | CHY1AP | Original Q1 | Legacy

## QUESTION ONE

This question is about limestone.

Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

**A** calcium carbonate

**B** carbon dioxide

**C** calcium oxide

**D** calcium hydroxide

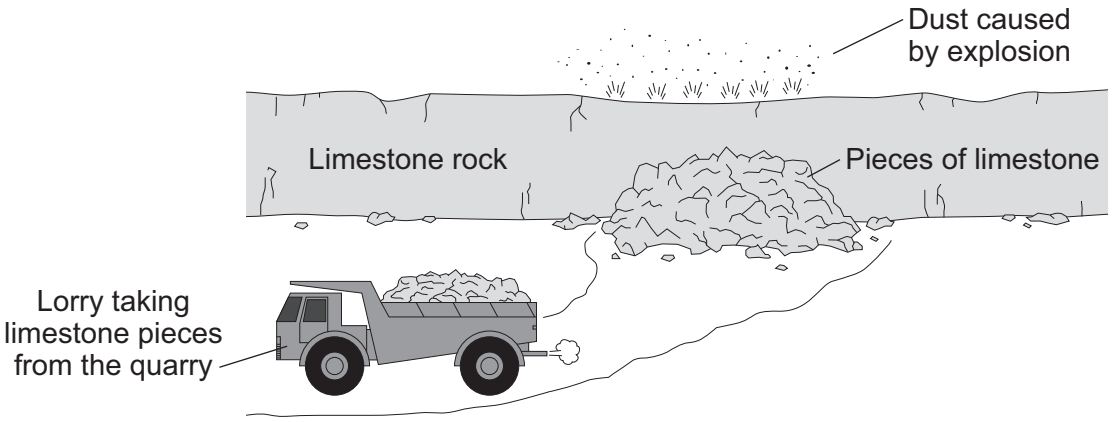
| | |
|---|---|
| **1** | This is a gas made when limestone is heated strongly. |
| **2** | Limestone is mainly made up of this compound. |
| **3** | This is another name for slaked lime. |
| **4** | This is another name for quicklime. |

### 4.8.3.3 Carbonates

**Question 09**

June 2010 | CHY1F | Original Q1 | Legacy

**1** In a quarry, limestone is blasted into pieces by explosives.
The pieces of limestone are taken from the quarry by lorries.




**1 (a)** Draw a ring around the correct word in the box to complete the sentence.

Limestone can be used as a | building / plastic / smart | material.

*(1 mark)*

**1 (b)** Tick (✓) **one** possible advantage for people who live near to the limestone quarry.

| Advantage | Tick (✓) |
|---|---|
| causes more traffic | |
| provides jobs | |
| attracts tourists to the area | |

*(1 mark)*

4.8.3.3 Carbonates

Question 09 · continued



**1 (c)** Give **two** types of pollution that would be caused by the limestone quarry.

1 .....

2 .....

*(2 marks)*

**1 (d)** Limestone contains calcium carbonate ($CaCO_3$).

Complete the **two** empty boxes in the table about the formula of calcium carbonate.

| Name of element | Symbol for the element | Number of atoms in the formula |
|---|---|---|
| calcium | Ca | 1 |
| carbon | C | 1 |
| oxygen | ..... | ..... |

*(2 marks)*

**1 (e)** Lorries take some of the limestone to be heated in a lime-kiln.
Calcium carbonate, in the limestone, decomposes when heated.

Use the balanced chemical equation to help you complete the word equation for the decomposition of calcium carbonate.

$CaCO_3 \rightarrow CaO + CO_2$

calcium carbonate → ..... + carbon dioxide

*(1 mark)*

7

### 4.8.3.3 Carbonates

**Question 10**

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.

4.8.3.3 Carbonates



**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**

### 4.8.3.3 Carbonates

**Question 11**

January 2011 | CHY3F | Original Q2 | Legacy

**2** Read the information in the box and then answer the questions.

> Seidlitz Powder is a medicine.
>
> Seidlitz Powder comes as two powders. One powder is wrapped in white paper and contains tartaric acid. The other powder is wrapped in blue paper and contains sodium hydrogencarbonate.
>
> The contents of the blue paper are dissolved in water and the contents of the white paper are added. This causes a reaction that produces carbon dioxide gas. The mixture is safe to drink when the reaction stops.

**2 (a)** Suggest why Seidlitz Powder comes as two separate powders.

.....

*(1 mark)*

**2 (b)** The reaction produces carbon dioxide gas.

**2 (b) (i)** What would you see during the reaction?

.....

*(1 mark)*

**2 (b) (ii)** Which state symbol in a chemical equation shows that carbon dioxide is a gas?

Draw a ring around **one** answer.

**(s)** **(l)** **(aq)** **(g)**

*(1 mark)*

**2 (b) (iii)** Draw a ring around the correct answer to complete the sentence.

Carbon dioxide can be identified because it turns [limescale / limestone / limewater] milky.

*(1 mark)*

4.8.3.3 Carbonates

Question 11 · continued



**2 (c)** Sodium hydrogencarbonate contains sodium ions. Sodium ions can be identified by flame tests.

Draw a ring around the correct answer to complete the sentence.

Sodium ions give a [blue / red / yellow] flame.

*(1 mark)*

**2 (d)** Some Seidlitz Powder was bought on the Internet for £5. However, when tested, it was found to be only magnesium sulfate, worth a few pence.

Draw a ring around the correct answer to complete each sentence.

**2 (d) (i)** The test for sulfate ions uses [barium chloride / silver nitrate / sodium hydroxide] solution.

*(1 mark)*

**2 (d) (ii)** A positive test for sulfate ions produces a [blue / red / white] precipitate.

*(1 mark)*

**2 (d) (iii)** Suggest **one** disadvantage of buying medicines on the Internet.

.....

.....

*(1 mark)*

8

### 4.8.3.3 Carbonates

**Question 12**

June 2011 | CHY1F | Original Q4 | Legacy

**4** An ore contains zinc carbonate ($ZnCO_3$).

**4 (a)** Complete the table to show the number of atoms of each element in the formula of zinc carbonate.

Zinc has been done for you.

| Element | Number of atoms in the formula $ZnCO_3$ |
|---|---|
| Zinc, Zn | 1 |
| Carbon, C | |
| Oxygen, O | |

*(2 marks)*

**4 (b)** Draw a ring around the correct answer to complete the sentence and the word equation.

**4 (b) (i)** Zinc carbonate decomposes in a similar way to calcium carbonate

when [ water is added. / cooled. / heated. ]

*(1 mark)*

**4 (b) (ii)** zinc carbonate ⟶ zinc oxide + [ carbon dioxide / hydrogen / oxygen ]

*(1 mark)*

**Question 4 continues on the next page**

4.8.3.3 Carbonates

Question 12 · continued

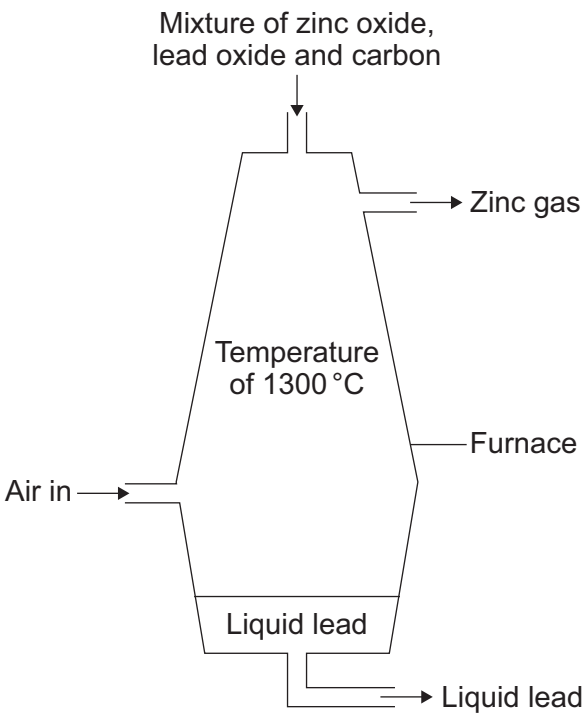


**4 (c)** Another ore contains a mixture of zinc carbonate and lead carbonate.

The metals zinc and lead are produced from this ore in two stages:

**Stage 1** decomposing the carbonates to produce a mixture of zinc oxide and lead oxide.

**Stage 2** mixing the oxides with carbon and heating in a furnace.




Some of the reactions in the furnace are:

zinc oxide + carbon → zinc + carbon dioxide

lead oxide + carbon → lead + carbon dioxide

carbon + oxygen → carbon dioxide

4.8.3.3 Carbonates

Question 12 · continued



Use the information given to help you to answer these questions.

**4 (c) (i)** Draw a ring around the correct answer to complete the sentence.

The reaction between carbon and oxygen that heats the furnace is called

- combustion.
- decomposition.
- evaporation.

*(1 mark)*

**4 (c) (ii)** Tick (✓) **one** reason why carbon reacts with zinc oxide to produce zinc.

| Reason | Tick (✓) |
|---|---|
| carbon is less reactive than zinc | |
| carbon is more reactive than zinc | |
| carbon is similar in reactivity to zinc | |

*(1 mark)*

**4 (c) (iii)** In the furnace zinc is a gas but lead is a liquid.

Suggest why.

.....

.....

.....

.....

*(2 marks)*

8

4.8.3.3 Carbonates

Question 13



**5** These labels have been taken from two bottles of spring water.

***Mountain View***

*Natural Spring Water*

*Contains essential minerals for good health*

**Analysis**

| Ions present | mg/dm$^3$ |
|---|---|
| Calcium | 65 |
| Magnesium | 35 |
| Potassium | 5 |
| Sodium | 12 |
| Chloride | 9 |
| Hydrogencarbonate | 269 |
| Sulfate | 21 |

Also tested by the independent Food Standards Agency and approved safe.

**Valley Croft**

***Pure Spring Water***

***With healthy minerals as Nature intended***

**Analysis**

| Ions present | mg/dm$^3$ |
|---|---|
| Calcium | 16 |
| Magnesium | 14 |
| Potassium | 5 |
| Sodium | 34 |
| Chloride | 13 |
| Hydrogencarbonate | 62 |
| Sulfate | 7 |

Pure and natural – contains no chemicals.

Tested in our own laboratories by our own scientists to keep you safe.

**5 (a)** Mountain View and Valley Croft spring waters are hard because they contain calcium and magnesium ions.

**5 (a) (i)** Mountain View spring water is about **three** times as hard as Valley Croft spring water.

Use the information on the labels to explain why.

.....

.....

.....

.....

*(2 marks)*

4.8.3.3 Carbonates

Question 13 · continued



**5 (a) (ii)** Describe how a student could use soap solution to show that Mountain View spring water is about **three** times as hard as Valley Croft spring water.

You should state how the experiment is made fair and give the expected result.

.....

.....

.....

.....

.....

.....

*(3 marks)*

**5 (b)** Why is hard water good for health?

.....

.....

*(1 mark)*

**5 (c)** Give **one** disadvantage of hard water.

.....

*(1 mark)*

**5 (d) (i)** Suggest why people should be concerned about the claim that Valley Croft spring water "contains no chemicals".

.....

.....

.....

*(1 mark)*

**5 (d) (ii)** Suggest why people should be concerned that Valley Croft spring water has only been tested by their own scientists.

.....

.....

.....

*(1 mark)*

9

### 4.8.3.3 Carbonates

**Question 14**

January 2012 | CH1FP | Original Q5 | Legacy

**5** Cement is made by heating a mixture of clay and limestone in a kiln.

**5 (a)** Many kilns are heated by burning natural gas (methane) in air.

A chemical equation for the burning of methane is:

$$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$$

Describe this reaction in words.

Give the names of the molecules **and** the numbers of each molecule in this chemical equation.

.....

.....

.....

.....

*(2 marks)*

**5 (b)** *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Limestone contains calcium carbonate.
There is a large deposit of limestone under an area of natural beauty.
A company wants to quarry this limestone and build a kiln near to the quarry to make cement.

**Area of natural beauty**



**A quarry**



Explosives will be used to extract the limestone out of the ground.

Heavy machinery will be used to lift and crush the limestone.

Lorries will be used to transport the limestone to the kiln to make cement.

The lorries and the heavy machinery will use diesel fuel.

**4.8.3.3 Carbonates**

**Question 14 · continued**



Quarrying limestone and making cement will have an impact on everything near the area.

Describe the positive and the negative impacts of quarrying limestone and making cement.

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*(6 marks)*

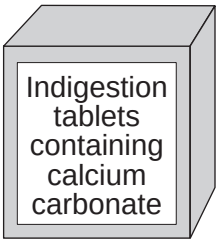
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### 4.8.3.3 Carbonates

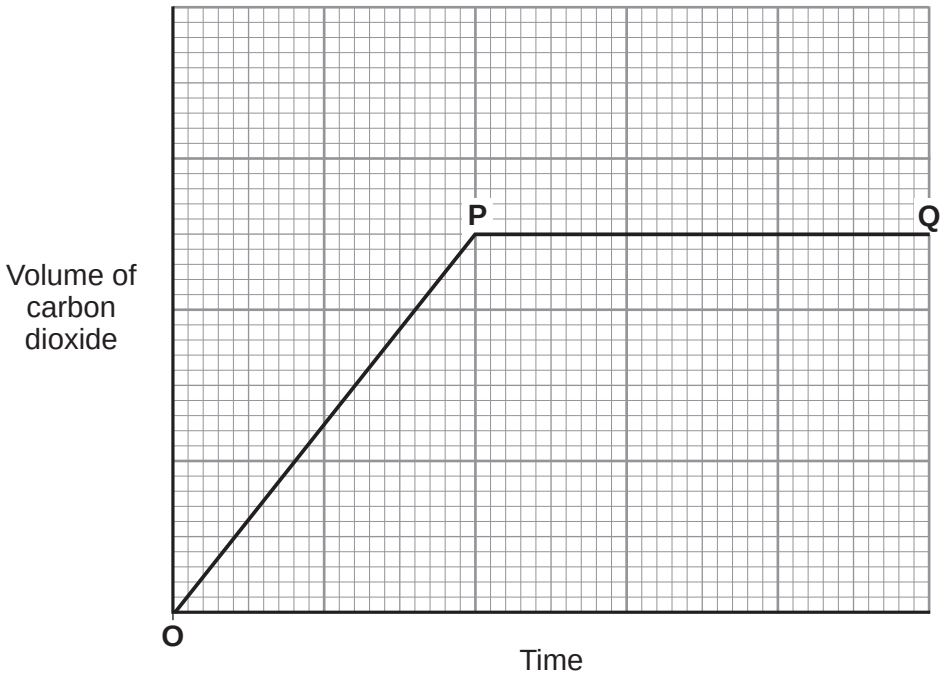
**Question 15**

June 2012 | CH1FP | Original Q4 | Legacy

**4** Human stomachs contain hydrochloric acid.
Stomach ache can be caused by too much acid in the stomach.
Indigestion tablets can be used to reduce the amount of acid in the stomach.




**4 (a)** The graph shows how the volume of carbon dioxide produced changes with time, after some calcium carbonate is added to hydrochloric acid.




**4 (a) (i)** Complete the sentence to explain what happens between **O** and **P**.

Between **O** and **P** the calcium carbonate and hydrochloric acid ..... .

*(1 mark)*

**4 (a) (ii)** Complete the sentence to explain what happens at **P**.

At **P** the calcium carbonate and hydrochloric acid .....

because .....

*(2 marks)*

4.8.3.3 Carbonates

Question 15 · continued



**4 (a) (iii)** Describe the test for carbon dioxide gas.

Test .....

Result of the test .....

*(2 marks)*

**4 (b)** Calcium carbonate is found in limestone.
Limestone is removed from the ground by quarrying.



Tick (✓) **one** advantage and tick (✓) **one** disadvantage of quarrying limestone.

| Statement | Advantage Tick (✓) | Disadvantage Tick (✓) |
|---|---|---|
| Quarrying limestone destroys the shells and skeletons of marine organisms that formed the limestone. | | |
| Quarrying limestone releases dust, and lorries release carbon dioxide from burning diesel fuel. | | |
| Quarrying limestone provides building materials, employment and new road links. | | |
| Quarrying limestone removes ores from the ground. | | |

*(2 marks)*

7

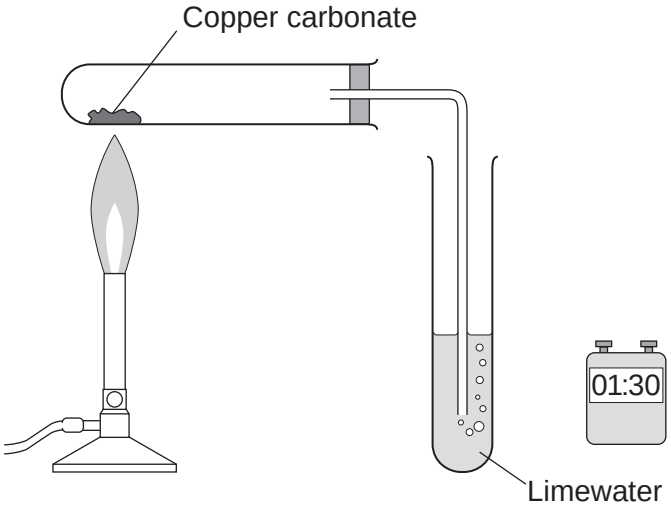
### 4.8.3.3 Carbonates

**Question 16**

January 2013 | CH1FP | Original Q6 | Legacy

**6** Carbon dioxide is produced when copper carbonate is heated.

A student investigated heating copper carbonate.
The student used the apparatus to measure how long it took for carbon dioxide to be produced.
The student also noted what happened during each minute for three minutes.




**6 (a)** The student used changes to the limewater to measure how long it took for carbon dioxide to be produced.

Describe how.

.....

.....

.....

.....

*(2 marks)*

4.8.3.3 Carbonates

Question 16 · continued



**6 (b)** The student wrote down her observations.

| Time interval in minutes | Observations |
|---|---|
| Between 0 and 1 | A slow release of gas bubbles.<br>The limewater did not change.<br>The solid in the test tube was green. |
| Between 1 and 2 | A fast release of gas bubbles.<br>The limewater changed at 1 minute 10 seconds. |
| Between 2 and 3 | No release of gas bubbles.<br>The solid in the test tube was black. |

**6 (b) (i)** Suggest the reason for the student's observations between 0 and 1 minute.

.....

.....

.....

.....

.....

*(2 marks)*

**6 (b) (ii)** Explain the student's observations between 1 and 2 minutes.

.....

.....

.....

.....

*(2 marks)*

**6 (b) (iii)** Explain the student's observations between 2 and 3 minutes.

.....

.....

.....

.....

*(2 marks)*

8

### 4.8.3.3 Carbonates

**Question 17**

June 2013 | CH1FP | Original Q3 | Legacy

**3** Carbon dioxide is produced when metal carbonates are heated.

**3 (a) (i)** Draw a ring around the correct answer to complete the word equation.

magnesium carbonate → [magnesium / magnesium hydroxide / magnesium oxide] + carbon dioxide

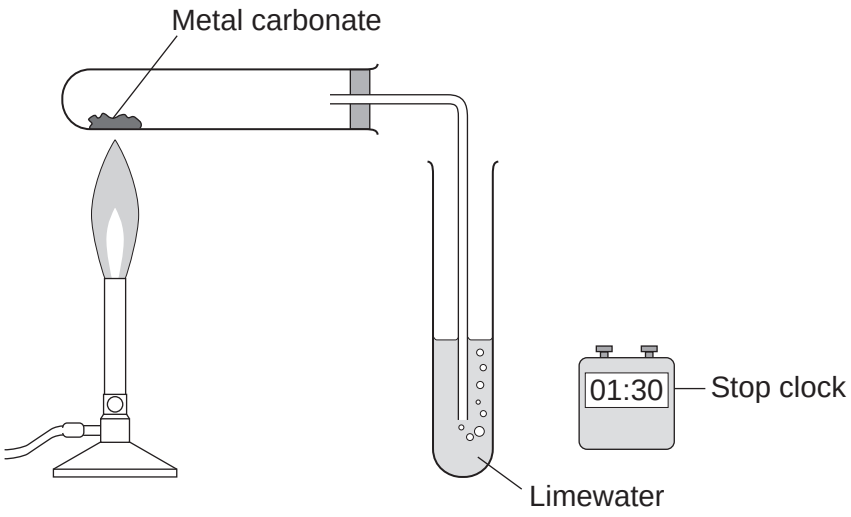
*(1 mark)*

**3 (a) (ii)** Draw a ring around the correct answer to complete the sentence.

The reaction to produce carbon dioxide from magnesium carbonate is [combustion. / decomposition. / fermentation.]

*(1 mark)*

**3 (b)** A student investigated what happens when metal carbonates are heated.




The student:

- used the apparatus to investigate heating four metal carbonates
- started the stop clock at the same time as he began to heat the metal carbonate
- stopped the stop clock when carbon dioxide was produced.

4.8.3.3 Carbonates

Question 17 · continued



The student's results are shown in the table.

| Metal carbonate | Time taken for the production of carbon dioxide to start in seconds |
|---|---|
| Calcium carbonate | 163 |
| Copper carbonate | 24 |
| Magnesium carbonate | 92 |
| Zinc carbonate | 67 |

**3 (b) (i)** Tick (✓) the type of graph the student should draw from these results.

| Type of graph | Tick (✓) |
|---|---|
| Bar chart | |
| Line graph | |
| Scatter graph | |

*(1 mark)*

**3 (b) (ii)** Use the Chemistry Data Sheet to help you to answer this question.

Draw a ring around the correct answer to complete the sentence.

The more reactive the metal in the carbonate the [less / more / same] time is taken for the production of carbon dioxide to start.

*(1 mark)*

**3 (b) (iii)** How did the student know that carbon dioxide was produced?

Use the diagram of the apparatus to help you to answer this question.

.....

.....

.....

.....

*(2 marks)*

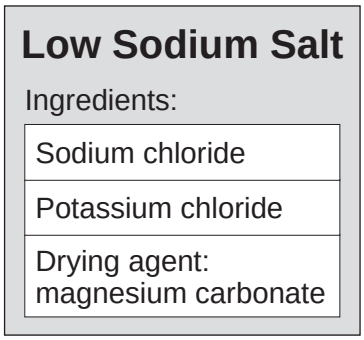
6

### 4.8.3.3 Carbonates

**Question 18**

June 2013 | CH3FP | Original Q2 | Legacy

**2** Low sodium salt is used on food. This label is from a packet of low sodium salt.




A chemist tests the low sodium salt for the substances on the label.

**2 (a)** The chemist tests for sodium ions and potassium ions using a flame test.

Draw a ring around the correct answer to complete each sentence.

**2 (a) (i)** In a flame test, sodium ions produce a [lilac / red / yellow] colour.

*(1 mark)*

**2 (a) (ii)** In a flame test, potassium ions produce a [lilac / red / yellow] colour.

*(1 mark)*

4.8.3.3 Carbonates

Question 18 · continued



**2 (b)** The chemist added hydrochloric acid to low sodium salt. Carbon dioxide gas was produced.

Describe the test for carbon dioxide and give the result of the test.

.....

.....

.....

.....

*(2 marks)*

**2 (c)** The chemist made a solution of low sodium salt.

**2 (c) (i)** Tick (✓) **one** box to show the chemical used to test for chloride ions.

| | **Tick (✓)** |
|---|---|
| Barium chloride solution | |
| Silver nitrate solution | |
| Sodium sulfate solution | |

*(1 mark)*

**2 (c) (ii)** Sodium hydroxide solution is used to test for magnesium ions.

Draw a ring around the colour of precipitate produced by this test.

**brown** **green** **white**

*(1 mark)*

6

**Turn to page 7 for the next question**

4.8.3.3 Carbonates

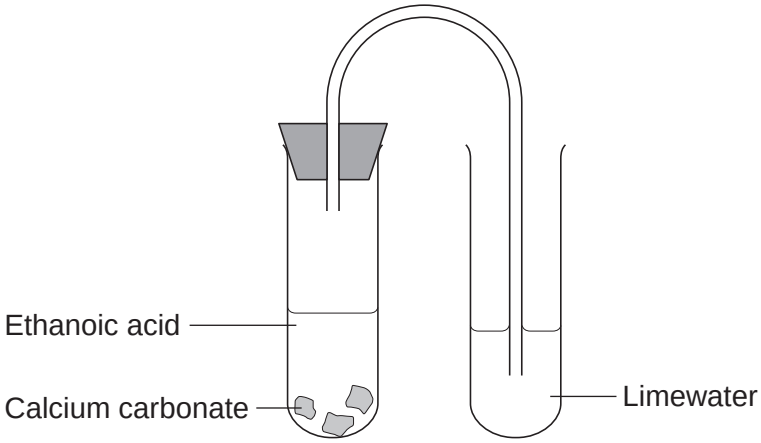
Question 19

June 2016 | CH3FP | Original Q5 | Legacy

**5** This question is about reactions of ethanoic acid and the analysis of salts.

**5 (a)** **Figure 7** shows the apparatus used to investigate the reaction of ethanoic acid with calcium carbonate.

**Figure 7**




**5 (a) (i)** Describe a change that would be seen in each test tube.

Give a reason for each change.

**[4 marks]**

**Test tube 1** _____

_____

_____

_____

**Test tube 2** _____

_____

_____

_____

**Question 5 continues on the next page**

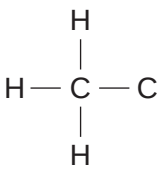
4.8.3.3 Carbonates

Question 19 · continued



**5 (a) (ii)** Complete the displayed structure of ethanoic acid.

**[1 mark]**



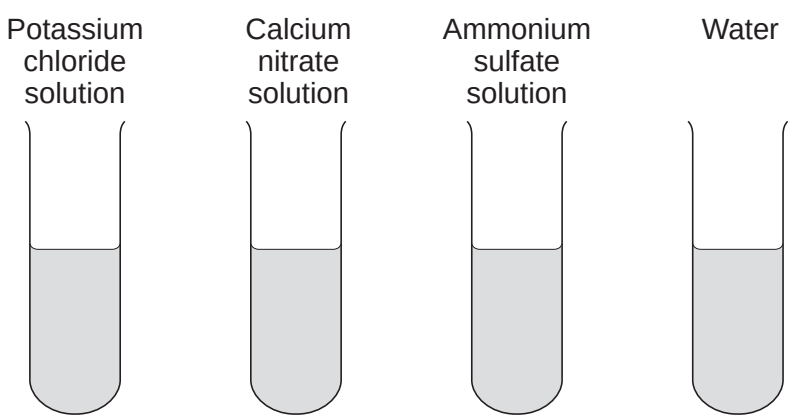

**5 (a) (iii)** Ethanoic acid is a carboxylic acid.
Complete the sentence.

**[2 marks]**

Carboxylic acids react with alcohols in the presence of an _____ catalyst to produce pleasant-smelling compounds called _____ .

**5 (b)** **Figure 8** shows four test tubes containing three different salt solutions and water.

**Figure 8**




Each solution and the water was tested with:

- silver nitrate in the presence of dilute nitric acid
- barium chloride in the presence of dilute hydrochloric acid.

4.8.3.3 Carbonates

Question 19 · continued



Complete the table of results.

**[2 marks]**

| | Potassium chloride solution | Calcium nitrate solution | Ammonium sulfate solution | Water |
|---|---|---|---|---|
| **Test with silver nitrate in the presence of dilute nitric acid** | | | no change | no change |
| **Test with barium chloride in the presence of dilute hydrochloric acid** | | no change | white precipitate | |

**5 (c)** Flame tests can be used to identify metal ions.

**5 (c) (i)** Complete the following sentences.

**[2 marks]**

The flame colour for potassium ions is _____ .

The flame colour for calcium ions is _____ .

**5 (c) (ii)** Give **one** reason why a flame test would **not** show the presence of both potassium ions and calcium ions in a mixture.

**[1 mark]**

_____

_____

_____

12

4.8.3.3 Carbonates

Question 20

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 _____.

4.8.3.3 Carbonates

Question 20 · 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]**

4.8.3.3 Carbonates

Question 20 · continued



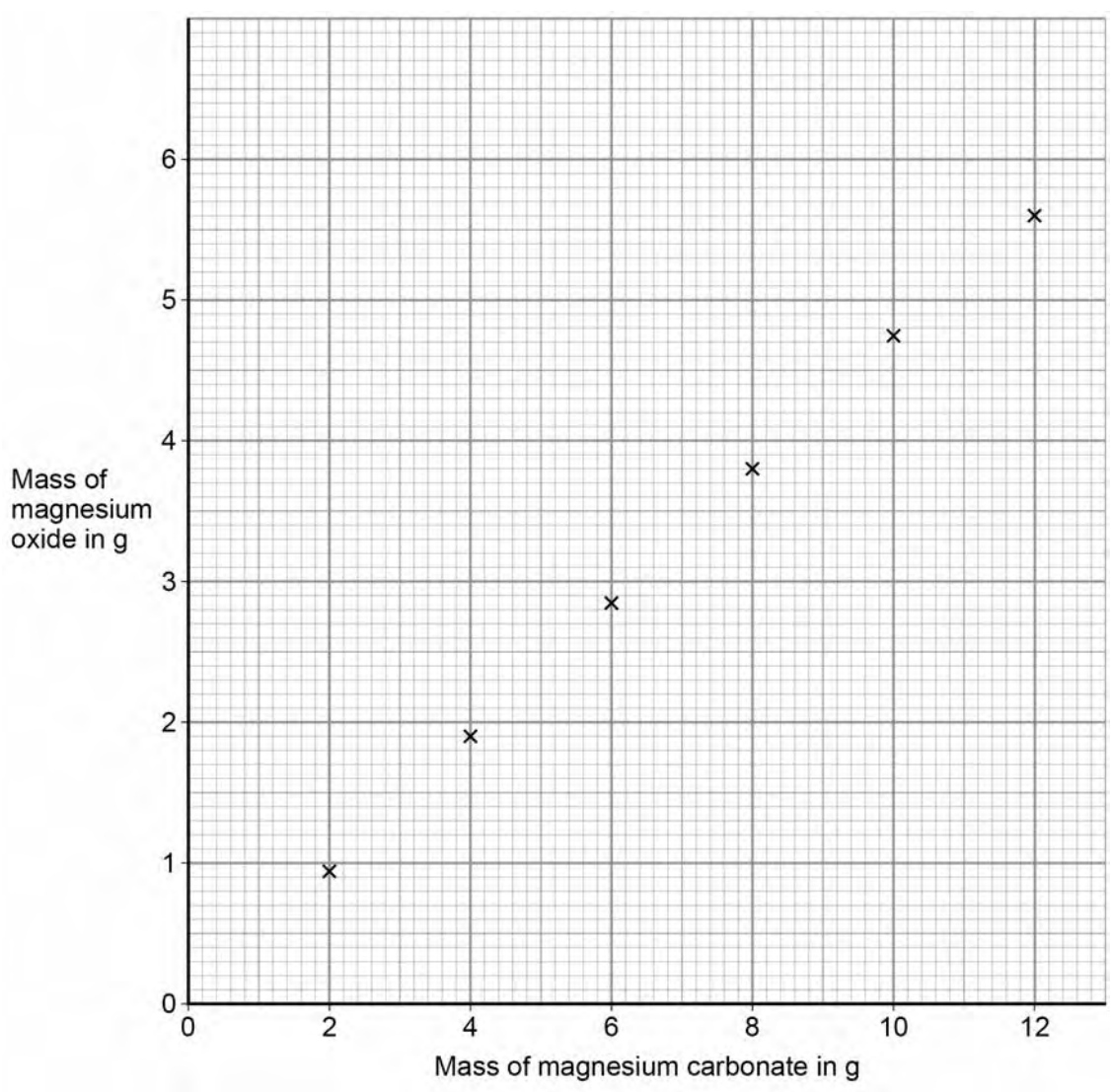
Another student repeated the investigation using magnesium carbonate instead of copper carbonate.

The word equation for the reaction is:

magnesium carbonate → magnesium oxide + carbon dioxide

**Figure 8** shows the results of the investigation.

**Figure 8**



4.8.3.3 Carbonates

Question 20 · 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

4.8.3.3 Carbonates

Question 21

June 2019 | 8462/2F | Original Q9

**0 9** This question is about lithium carbonate.

Lithium carbonate is used in medicines.

**Figure 7** shows a tablet containing lithium carbonate.

**Figure 7**



**0 9 . 1** Lithium carbonate contains lithium ions and carbonate ions.

A student tested the tablet for lithium ions and for carbonate ions.

The student used:

- a metal wire
- dilute hydrochloric acid
- limewater.

Plan an investigation to show the presence of lithium ions **and** of carbonate ions in the tablet.

You should include the results of the tests for the ions.

**[6 marks]**

4.8.3.3 Carbonates

Question 21 · continued



**0 9 . 2** The tablet also contains other substances.

The substances in tablets are present in fixed amounts.

What name is given to mixtures like tablets?

**[1 mark]**

**0 9 . 3** The tablet has a mass of 1.20 g and contains 700 mg of lithium carbonate.

Calculate the percentage by mass of lithium carbonate in this tablet.

**[3 marks]**

Percentage by mass of lithium carbonate = _____ %

10

### 4.8.3.3 Carbonates

**Question 22**

November 2020 | 8462/2F | Original Q3

**0 3** This question is about the rate of the reaction between hydrochloric acid and calcium carbonate.

A student investigated the effect of changing the size of calcium carbonate lumps on the rate of this reaction.

This is the method used.

1. Pour hydrochloric acid into a conical flask up to the 50 $cm^3$ line.
2. Add 10.0 g of small calcium carbonate lumps to the conical flask.
3. Attach a gas syringe to the conical flask.
4. Measure the volume of gas produced every 20 seconds for 100 seconds.
5. Repeat steps 1 to 4 using 10.0 g of large calcium carbonate lumps.

**0 3 . 1** The student used the 50 $cm^3$ line on the conical flask to measure the volume of hydrochloric acid.

Suggest a piece of equipment the student could use to make the measurement of volume more accurate.

**[1 mark]**

**0 3 . 2** Carbon dioxide gas is produced in the reaction between hydrochloric acid and calcium carbonate.

Which test is used to identify carbon dioxide gas?

**[1 mark]**

Tick (✓) **one** box.

- A burning splint pops ☐
- A glowing splint relights ☐
- Damp litmus paper is bleached ☐
- Limewater turns milky ☐

4.8.3.3 Carbonates

Question 22 · continued



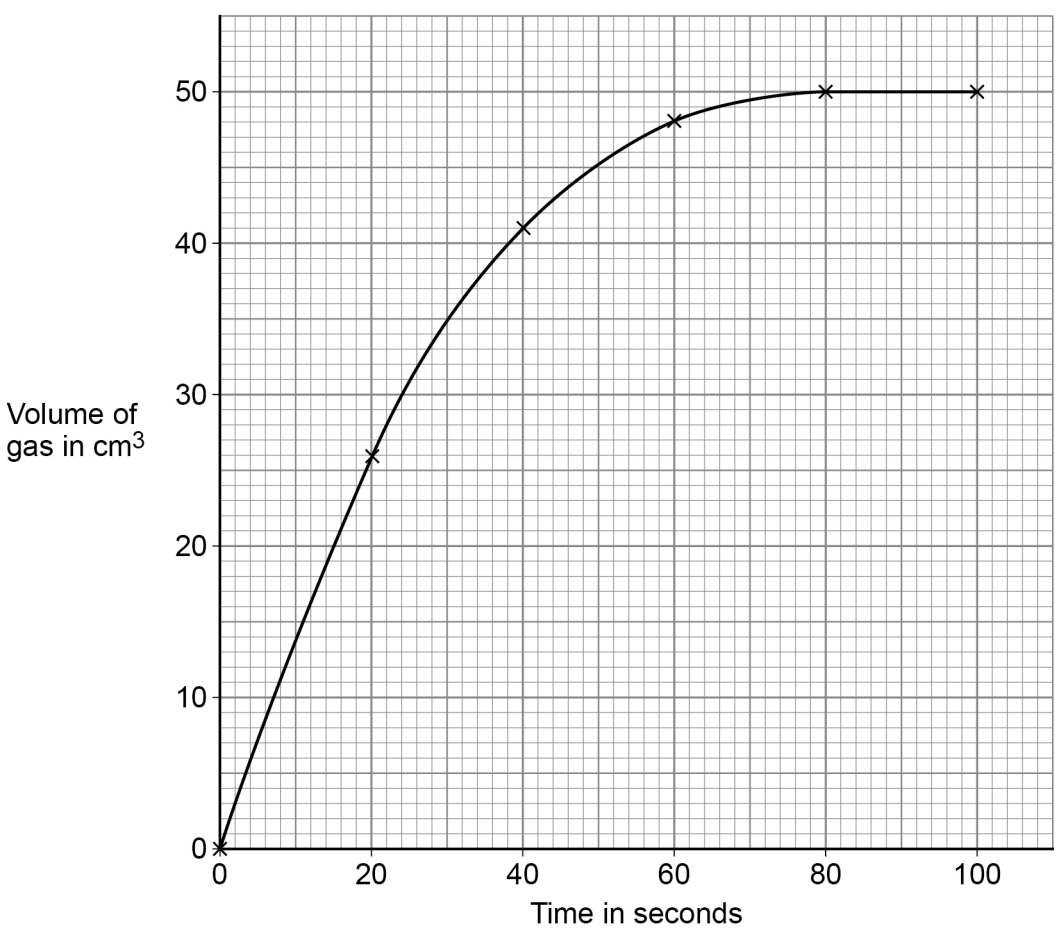
**Table 2** shows the student's results for large calcium carbonate lumps.

**Table 2**

| Time in seconds | Volume of gas in $cm^3$ |
|---|---|
| 0 | 0 |
| 20 | 16 |
| 40 | 30 |
| 60 | 40 |
| 80 | 46 |
| 100 | 48 |

**Figure 4** shows the student's results for small calcium carbonate lumps.

**Figure 4**



4.8.3.3 Carbonates

Question 22 · continued



**0 3 . 3** Complete **Figure 4**.

You should:

- plot the data for large calcium carbonate lumps from **Table 2** on **Figure 4**
- draw a line of best fit for large calcium carbonate lumps.

**[3 marks]**

**0 3 . 4** Determine the mean rate of reaction using **small** calcium carbonate lumps between 0 seconds and 60 seconds.

Use the equation:

$$\text{mean rate of reaction} = \frac{\text{volume of gas produced}}{\text{time taken}}$$

Use **Figure 4**.

**[3 marks]**

Mean rate of reaction = _____ $cm^3/s$

**0 3 . 5** Describe what happens to the volume of gas collected using **small** calcium carbonate lumps:

- between 0 and 20 seconds
- between 80 and 100 seconds.

Use **Figure 4**.

**[2 marks]**

Between 0 and 20 seconds _____

Between 80 and 100 seconds _____

4.8.3.3 Carbonates



**0 3 . 6** The balance used to weigh 10.0 g of calcium carbonate lumps caused an error.

The balance always read 0.2 g before being used.

What type of error was caused by the balance?

**[1 mark]**

Tick (✓) **one** box.

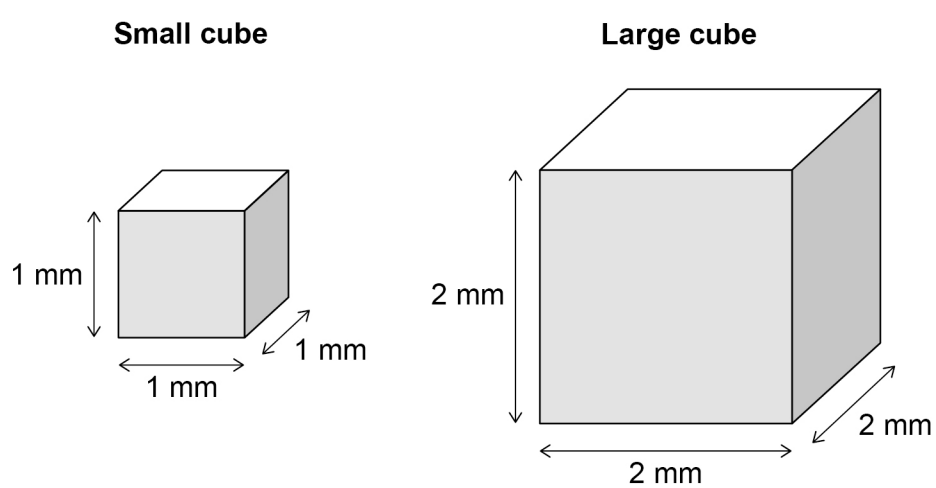
Human error ☐

Random error ☐

Systematic error ☐

**Figure 5** shows the dimensions of two cubes of calcium carbonate.

**Figure 5**



4.8.3.3 Carbonates

Question 22 · continued



**0 3 . 7** A cube of calcium carbonate has six faces.

Calculate the total surface area of the **large** cube of calcium carbonate.

Use **Figure 5**.

**[3 marks]**

Total surface area = _____ $mm^2$

**0 3 . 8** The large cube of calcium carbonate was divided into eight smaller cubes.

The eight smaller cubes have a greater total surface area than the one large cube.

Compare the rate of reaction when using the eight smaller cubes with the rate of reaction when using the large cube.

Complete the sentence.

Choose the answer from the box.

**[1 mark]**

| | | |
|---|---|---|
| **faster** | **slower** | **the same** |

The rate of reaction of the eight smaller cubes is _____.

15

4.8.3.3 Carbonates

Question 23

June 2024 | 8462/2F | Original Q7

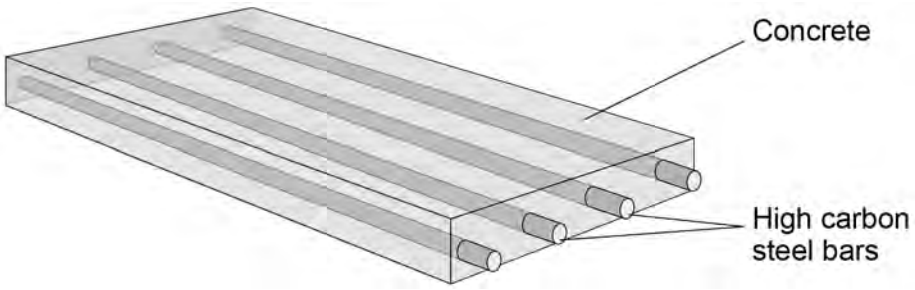
**0 7** This question is about materials.

Pre-stressed concrete is a composite material.

The concrete is strengthened using high carbon steel bars.

**Figure 8** shows the structure of a piece of pre-stressed concrete.

**Figure 8**




**0 7 . 1** Which **two** words describe the high carbon steel bars?

**[2 marks]**

Tick (✓) **two** boxes.

- Alloy ☐
- Binder ☐
- Matrix ☐
- Ore ☐
- Reinforcement ☐

4.8.3.3 Carbonates

Question 23 · continued



Limestone is mainly calcium carbonate.

Limestone is a raw material used in the production of concrete.

**0 7 . 2** In the first part of the production of concrete:

- air is heated by burning methane
- the hot air is used to heat limestone
- the limestone decomposes.

The equation for the decomposition of limestone is:

calcium carbonate → calcium oxide + carbon dioxide

Give **two** ways in which a greenhouse gas is released in this process.

**[2 marks]**

1 _____

_____

2 _____

_____

**0 7 . 3** How could a sample of limestone be tested to show the presence of carbonate ions?

Complete the sentences.

Choose answers from the box.

**[2 marks]**

| | | |
|---|---|---|
| **barium chloride** | **hydrochloric acid** | **limewater** |
| **sodium hydroxide** | | **universal indicator** |

The substance added to the limestone is _____.

The gas produced is identified using _____.

**Question 7 continues on the next page**

4.8.3.3 Carbonates

Question 23 · continued



**Table 4** gives some information about plain concrete and pre-stressed concrete.

**Table 4**

| | Plain concrete | Pre-stressed concrete |
|---|---|---|
| Cost in £ per $m^3$ | 75 | 225 |
| Density in kg per $m^3$ | 2300 | 2500 |
| Strength in arbitrary units | 600 | 3000 |

**0 7 . 4** Explain why pre-stressed concrete rather than plain concrete is used to make bridges that carry heavy lorries.

Use **Table 4**.

**[2 marks]**

4.8.3.3 Carbonates

Question 23 · continued



**0 7 . 5** **Figure 9** shows a garden path made of plain concrete slabs.

**Figure 9**



Suggest **two** reasons why plain concrete rather than pre-stressed concrete is used to make slabs for garden paths.

Use **Table 4**.

**[2 marks]**

1 _____

_____

2 _____

_____

10