AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.8.3.3

Carbonates

Past-paper questions

Tier	**Higher**
Question groups	**17**
Available paper years	**2008–2025**

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.

4.8.3.3 Carbonates

Question 01

January 2008 | CHY1H | Original Q2 | Legacy

2 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?

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(1 mark)

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

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(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)

4.8.3.3 Carbonates

Question 01 · continued

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(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?

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.....

(1 mark)

7

Turn over for the next question

4.8.3.3 Carbonates

Question 02

January 2008 | CHY2H | Original Q6 | Legacy

6 Photographic film often contains silver bromide. Silver bromide is changed by light to form silver which appears as a black solid. This darkens the photographic film.

A photographic film can be made by coating thin transparent plastic with a gel containing silver bromide.

The main steps in making this photographic film are as follows:

Step 1 Gelatine is dissolved in warm water to make a solution.

Step 2 Compound **A**, a soluble compound which contains bromide ions, is dissolved into this solution.

Step 3 The lights are turned out in the darkroom.

Step 4 Compound **B**, a soluble compound which contains silver ions, is dissolved in water.

Step 5 The solution of compound **B** is added to the solution containing compound **A** and gelatine. Solid silver bromide is formed.

Step 6 The warm mixture is poured onto thin, transparent plastic film.

Step 7 The mixture sets to form a gel containing solid silver bromide.

(a) The table below gives information about the solubility of some compounds.

SOLUBLE	INSOLUBLE
All sodium and potassium salts	
All nitrates	
Most chlorides, bromides and iodides	Silver and lead chlorides, bromides and iodides
Most sulfates	Lead sulfate and barium sulfate
Sodium, potassium and ammonium carbonates	Most other carbonates

Use the table to help you to name suitable compounds for **A** and **B**.

Compound **A** .....

Compound **B** .....

(2 marks)

4.8.3.3 Carbonates

Question 02 · continued

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(b) Suggest why the lights are turned out at **step 3** in this method of making a photographic film.

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.....

(1 mark)

(c) What type of chemical reaction takes place when the compounds are mixed in **step 5**?

.....

(1 mark)

(d) The photographic film is placed in a camera and a picture is taken. Where light hits the photographic film the silver ions (Ag^+) are changed into silver metal (Ag).

Explain why this reaction is a reduction.

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(2 marks)

6

4.8.3.3 Carbonates

Question 03

6 (a) Four bottles of chemicals made in the 1880s were found recently in a cupboard during a Health and Safety inspection at Lovell Laboratories.



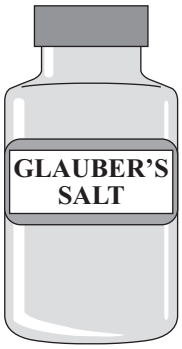
Sodium carbonate



Sodium chloride



Sodium nitrate



Sodium sulfate

The chemicals are correctly named.

You are provided with the following reagents:

- aluminium powder
- barium chloride solution acidified with dilute hydrochloric acid
- dilute hydrochloric acid
- silver nitrate solution acidified with dilute nitric acid
- sodium hydroxide solution.

4.8.3.3 Carbonates

Question 03 · continued

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(i) Describe tests to show that these chemicals are correctly named.

In each case give the reagent(s) you would use and state what you would see.

Test and result for carbonate ions:

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.....

Test and result for chloride ions:

.....

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Test and result for nitrate ions:

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.....

Test and result for sulfate ions:

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(5 marks)

(ii) Suggest why a flame test would **not** distinguish between these four chemicals.

.....

(1 mark)

(b) Instrumental methods of analysis linked to computers can be used to identify chemicals.

Describe **two** advantages of using instrumental methods of analysis.

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(2 marks)

8

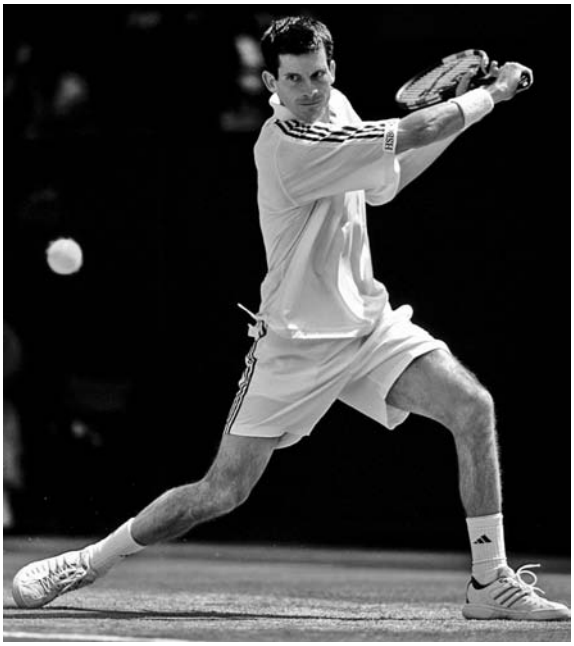
4.8.3.3 Carbonates

Question 04

June 2008 | CHY3H | 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, $(NH_4)_2CO_3$.

Describe how *smelling salts* can be tested to show that they contain ammonium ions and carbonate ions. Give the results of the tests.

3 (a) Test and result for ammonium ions

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(2 marks)

3 (b) Test and result for carbonate ions

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(2 marks)

4

4.8.3.3 Carbonates

Question 05

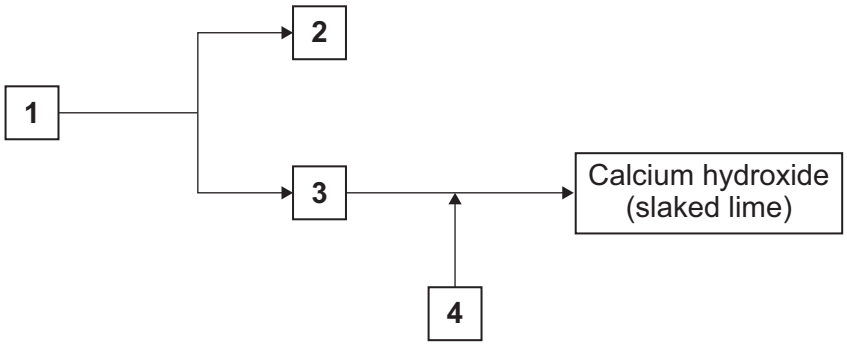
November 2010 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

The equation for the reaction in a lime kiln is:

$$\underset{CaCO_3}{\text{calcium carbonate}} \longrightarrow \underset{CaO}{\text{calcium oxide}} + \underset{CO_2}{\text{carbon dioxide}}$$

The flow chart shows this reaction and a further reaction of one of the products.



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

A Water

B Calcium oxide

C Calcium carbonate

D Carbon dioxide

4.8.3.3 Carbonates

Question 06

June 2011 | 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 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.

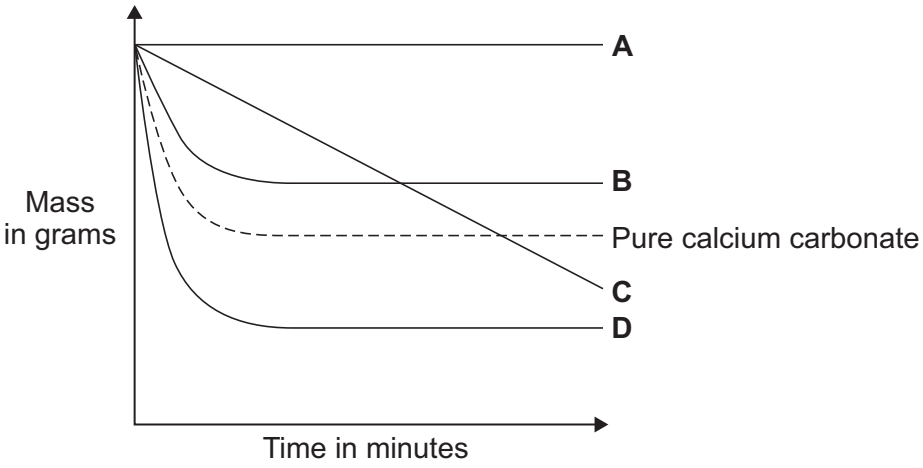
4.8.3.3 Carbonates

Question 06 · 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.

4.8.3.3 Carbonates

Question 07

1 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.

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

1 (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.

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(2 marks)

4.8.3.3 Carbonates

Question 07 · continued

1 (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.

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(3 marks)

1 (b) Why is hard water good for health?

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(1 mark)

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

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(1 mark)

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

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(1 mark)

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

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(1 mark)

9

4.8.3.3 Carbonates

Question 08

January 2012 | CH1HP | Original Q6 | Legacy

6 Limestone is used as a building material. Acid rain erodes limestone.

6 (a) Limestone contains calcium carbonate.
The symbol equation for the reaction of calcium carbonate with hydrochloric acid is shown.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

Describe a test to show that carbon dioxide is produced in this reaction.

Give the result of the test.

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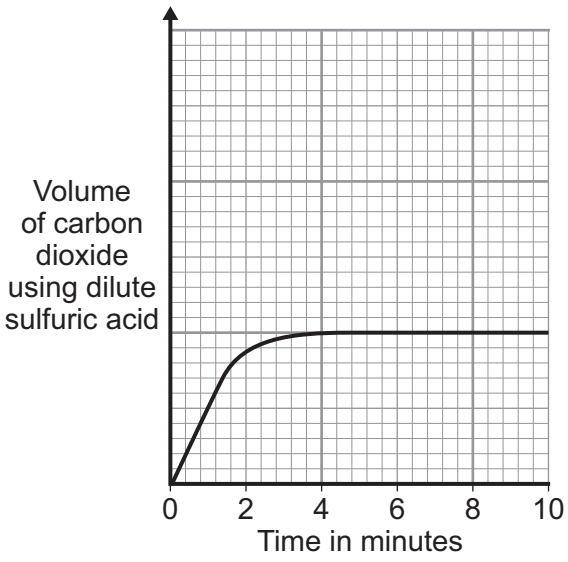
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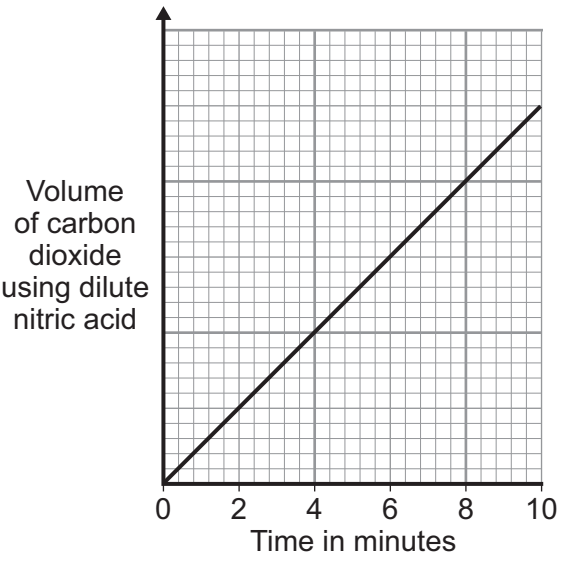
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(2 marks)

6 (b) Gases from vehicle exhausts produce sulfuric acid and nitric acid.

A student investigated the reaction of these two acids with calcium carbonate (limestone).
The type of acid was changed but all other variables were kept the same.
The student measured the volume of carbon dioxide produced each minute for a total of 10 minutes. He did this first for the reaction between dilute sulfuric acid and a cube of calcium carbonate (limestone).
The student repeated the experiment using dilute nitric acid in place of the dilute sulfuric acid.
The results are shown below.





4.8.3.3 Carbonates

Question 08 · continued

6 (b) (i) State **two** variables that must be kept the same for this investigation.

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(2 marks)

6 (b) (ii) Reacting calcium carbonate with sulfuric acid gave different results to nitric acid.

The symbol equations for the reaction of calcium carbonate with sulfuric acid and with nitric acid are shown below.

$CaCO_3(s) + H_2SO_4(aq) \rightarrow CaSO_4(s) + H_2O(l) + CO_2(g)$

$CaCO_3(s) + 2HNO_3(aq) \rightarrow Ca(NO_3)_2(aq) + H_2O(l) + CO_2(g)$

Describe how the results for sulfuric acid are different **and** use the symbol equations to explain this difference.

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(3 marks)

7

4.8.3.3 Carbonates

Question 09

June 2012 | CH1HP | Original Q5 | Legacy

5 Calcium carbonate is found in limestone.
Limestone is used as a building material.
Limestone is also used to make calcium oxide and calcium hydroxide.

5 (a) Limestone is heated to make calcium oxide.

5 (a) (i) Calcium oxide reacts with a substance to produce calcium hydroxide.
Name the substance.

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(1 mark)

5 (a) (ii) Calcium hydroxide reacts with a substance to produce calcium carbonate.
Name the substance.

.....

(1 mark)

5 (b) Limestone reacts with acids.

5 (b) (i) Balance the chemical equation for the reaction of calcium carbonate with hydrochloric acid.

$$CaCO_3 + HCl \longrightarrow CaCl_2 + CO_2 + H_2O$$

(1 mark)

5 (b) (ii) Buildings made from limestone are affected by the products from burning fossil fuels containing sulfur.

Explain why.

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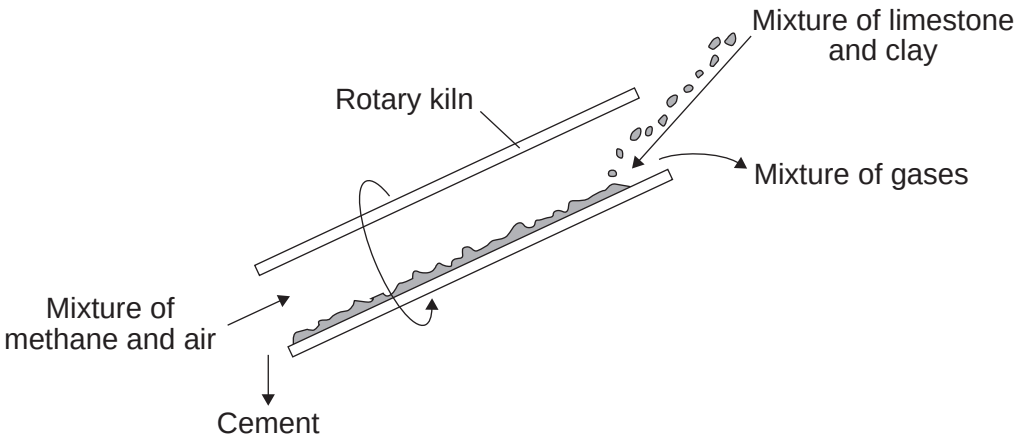
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(2 marks)

4.8.3.3 Carbonates

Question 09 · continued

5 (c) When a mixture of limestone and clay is heated in a rotary kiln cement is produced.
Burning a mixture of methane and air heats the kiln.
Clay does not decompose in the kiln.



5 (c) (i) Carbon dioxide is one of the main gases in the mixture of gases coming out of the kiln.

Give **two** reasons why.

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(2 marks)

5 (c) (ii) Name the other main gas in the mixture of gases coming out of the kiln.

Give a reason why there is a high percentage of this gas in the mixture of gases coming out of the kiln.

Name of gas .....

Reason .....

.....

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(2 marks)

9

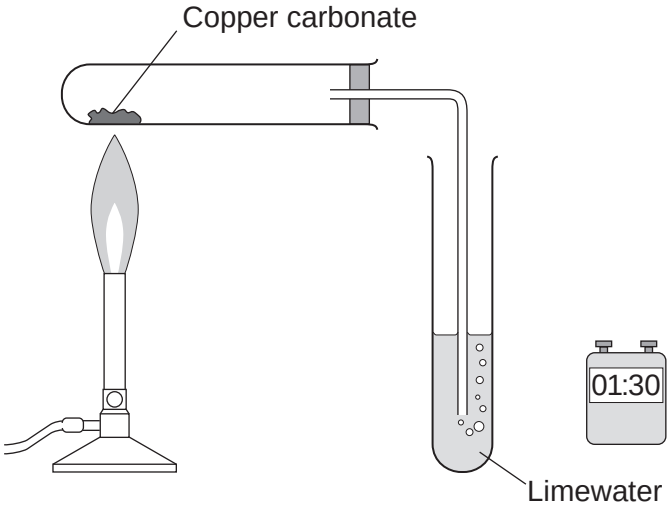
4.8.3.3 Carbonates

Question 10

January 2013 | CH1HP | Original Q2 | Legacy

2 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.



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

Describe how.

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(2 marks)

4.8.3.3 Carbonates

Question 10 · continued

2 (b) The student wrote down her observations.

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

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

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(2 marks)

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

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(2 marks)

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

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(2 marks)

8

4.8.3.3 Carbonates

Question 11

June 2013 | CH1HP | Original Q5 | Legacy

5 The amount of carbon dioxide in the Earth's atmosphere has changed since the Earth was formed.
The amount of carbon dioxide continues to change because of human activities.

5 (a) Cement is produced when a mixture of calcium carbonate and clay is heated in a rotary kiln. The fuel mixture is a hydrocarbon and air.

Hydrocarbons react with oxygen to produce carbon dioxide.
Calcium carbonate decomposes to produce carbon dioxide.

5 (a) (i) Complete each chemical equation by writing the formula of the other product.

$$CH_4 + 2O_2 \longrightarrow 2 \text{ .....} + CO_2$$

$$CaCO_3 \longrightarrow \text{.....} + CO_2$$

(2 marks)

5 (a) (ii) Hydrocarbons and calcium carbonate contain *locked up* carbon dioxide.

What is *locked up* carbon dioxide?

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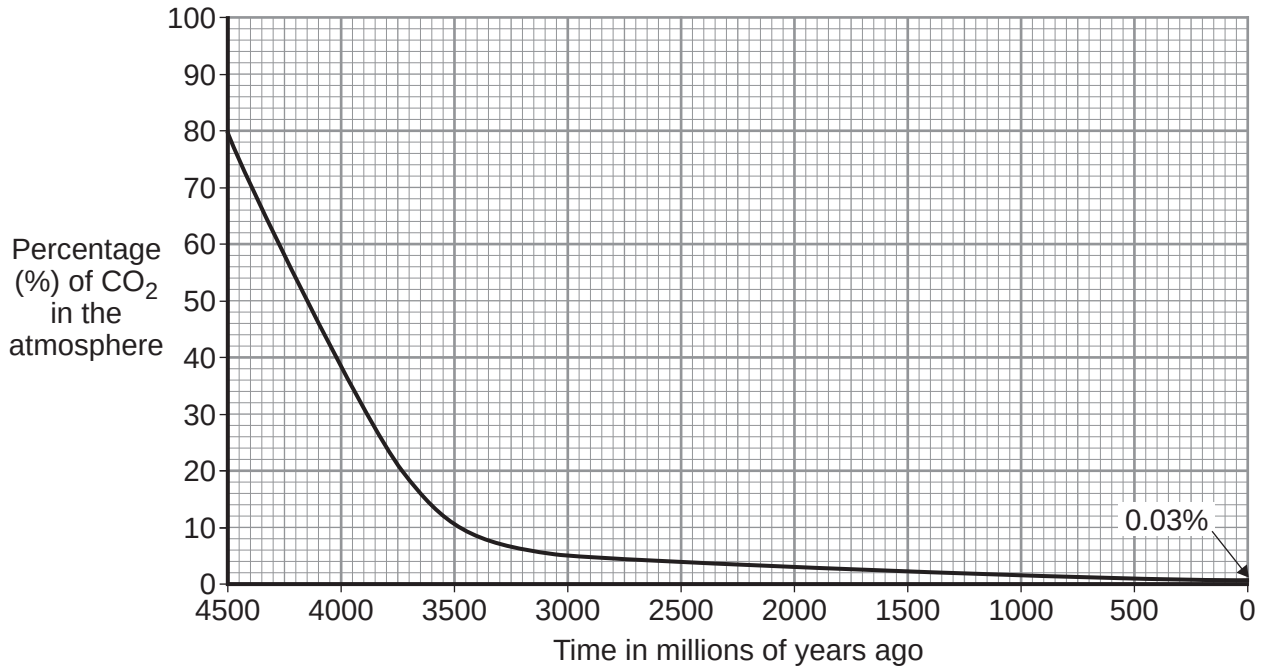
(2 marks)

4.8.3.3 Carbonates

Question 11 · continued

5 (b) **Graph 1** shows how the percentage of carbon dioxide in the atmosphere changed in the last 4500 million years.

Graph 1



Use information from **Graph 1** to answer these questions.

5 (b) (i) Describe how the percentage of carbon dioxide has changed in the last 4500 million years.

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(2 marks)

5 (b) (ii) Give **two** reasons why the percentage of carbon dioxide has changed.

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(2 marks)

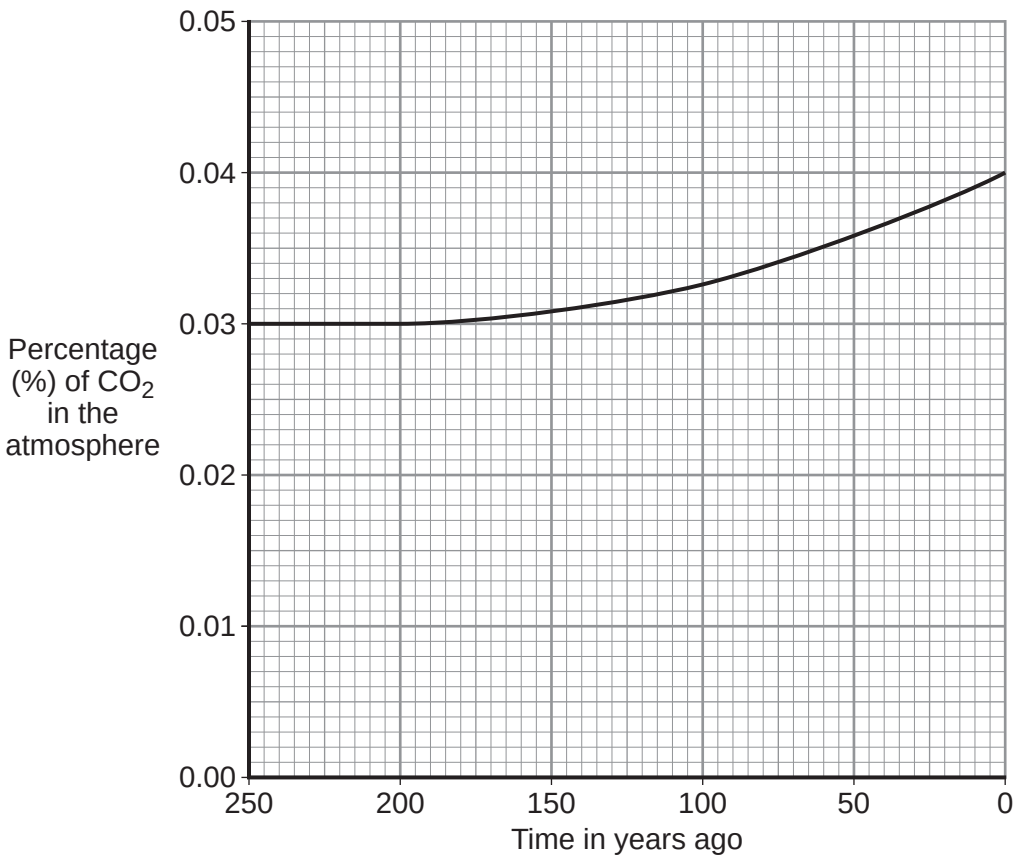
Question 5 continues on the next page

4.8.3.3 Carbonates

Question 11 · continued

5 (c) **Graph 2** shows how the percentage of carbon dioxide in the atmosphere changed in the last 250 years.

Graph 2



Should we be concerned about this change in the percentage of carbon dioxide?

Explain your answer.

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(2 marks)

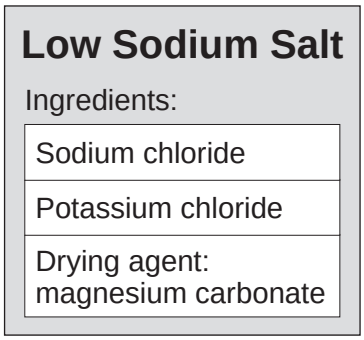
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4.8.3.3 Carbonates

Question 12

June 2013 | CH3HP | Original Q5 | Legacy

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



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

5 (a) (i) The same test can be used to identify sodium ions and potassium ions.

Describe the test.

Give the result of the test for sodium ions and for potassium ions.

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(3 marks)

5 (a) (ii) It is difficult to identify potassium ions when sodium ions are present.

Suggest why.

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(1 mark)

4.8.3.3 Carbonates

Question 12 · continued

5 (b) Describe how the student would test a solution of the low sodium salt for chloride ions.

Give the result of the test.

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(3 marks)

5 (c) To test for magnesium ions, the student adds a few drops of sodium hydroxide solution to a solution of the low sodium salt.

A white precipitate is produced.

This test also gives a white precipitate with aluminium ions and calcium ions.

5 (c) (i) Describe how the student could confirm that the low sodium salt contains magnesium ions and **not** aluminium ions.

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(2 marks)

5 (c) (ii) Describe a test the student could do to confirm that the low sodium salt does **not** contain calcium ions.

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(2 marks)

11

4.8.3.3 Carbonates

Question 13

June 2014 | CH3HP | Original Q7 | Legacy

7 The colours of fireworks are produced by chemicals.

Figure 10



7 (a) Information about four chemicals is given in **Table 2**.

Complete **Table 2**.

[2 marks]

Table 2

Chemical	Colour produced in firework
barium chloride	green
..... carbonate	crimson
sodium nitrate	.....
calcium sulfate	red

4.8.3.3 Carbonates

Question 13 · continued

7 (b) Describe a test to show that barium chloride solution contains chloride ions.

Give the result of the test.

[2 marks]

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.....

7 (c) A student did two tests on a solution of compound **X**.

Test 1
Sodium hydroxide solution was added.
A blue precipitate was formed.

Test 2
Dilute hydrochloric acid was added.
Barium chloride solution was then added.
A white precipitate was formed.

The student concluded that compound **X** is iron(II) sulfate.

Is the student's conclusion correct?

Explain your answer.

[3 marks]

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7

4.8.3.3 Carbonates

Question 14

June 2016 | CH1HP | Original Q3 | Legacy

3 Metals are extracted from ores in the Earth's crust.

Some ores contain metal carbonates and some ores contain metal oxides.

3 (a) (i) Name the type of reaction that happens when a metal carbonate is heated.

[1 mark]

_____

3 (a) (ii) Which solid product is formed when copper carbonate is heated?

[1 mark]

Tick (✓) **one** box.

copper ☐

copper nitrate ☐

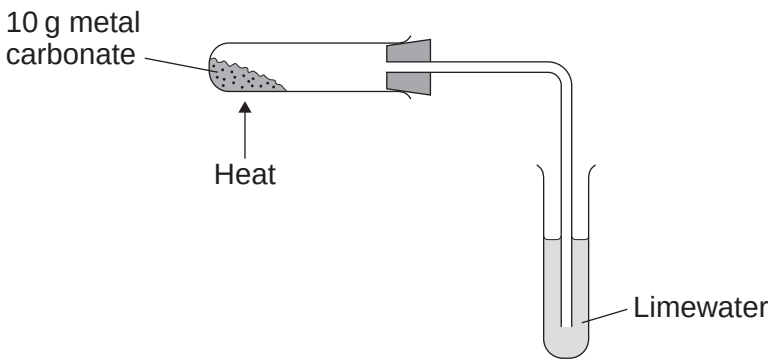
copper oxide ☐

copper sulfide ☐

3 (b) A student investigated heating four metal carbonates.

Figure 4 shows the apparatus used.

Figure 4



4.8.3.3 Carbonates

Question 14 · continued

The student heated each metal carbonate for five minutes.

Table 3 shows the results.

Table 3

Metal carbonate	Mass of metal carbonate at start in g	Mass of solid after heating for 5 minutes in g	Observations
Copper carbonate	10.0	6.9	Limewater turns cloudy
Magnesium carbonate	10.0	9.1	Limewater turns cloudy
Potassium carbonate	10.0	10.0	Limewater does not turn cloudy
Zinc carbonate	10.0	8.3	Limewater turns cloudy

3 (b) (i) Explain the results for potassium carbonate.

[3 marks]

3 (b) (ii) Suggest how the reactivity series can be used to predict which metal carbonate reacts most easily when heated.

[2 marks]

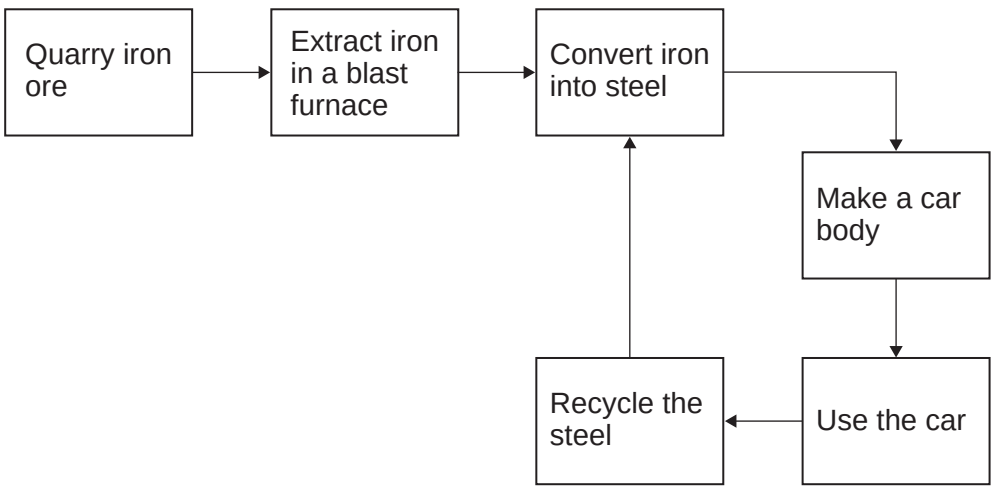
Question 3 continues on the next page

4.8.3.3 Carbonates

Question 14 · continued

3 (c) **Figure 5** shows a simple life cycle of a car body.

Figure 5



3 (c) (i) Complete the sentence.

[1 mark]

Iron ores must contain enough iron to _____

_____

3 (c) (ii) Some iron ores contain iron oxide (Fe_2O_3).

Complete and balance the equation for a reaction to produce iron from iron oxide.

[2 marks]

_____ Fe_2O_3 + _____ C ⟶ _____ + _____ CO_2

3 (c) (iii) Give **two** reasons why iron produced in a blast furnace is converted into steel.

[2 marks]

_____

_____

_____

_____

4.8.3.3 Carbonates

Question 14 · continued

3 (c) (iv) When a car reaches the end of its useful life, the car body can be:

- recycled
- reused
- sent to landfill.

Give **three** reasons why a steel car body should be recycled and **not** reused or sent to landfill.

[3 marks]

15

4.8.3.3 Carbonates

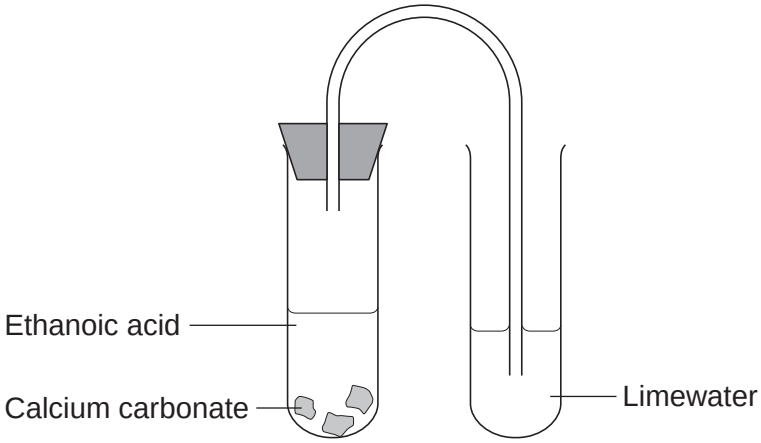
Question 15

June 2016 | CH3HP | Original Q1 | Legacy

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

1 (a) **Figure 1** shows the apparatus used to investigate the reaction of ethanoic acid with calcium carbonate.

Figure 1



1 (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 _____

_____

_____

_____

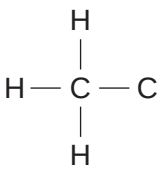
Question 1 continues on the next page

4.8.3.3 Carbonates

Question 15 · continued

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

[1 mark]



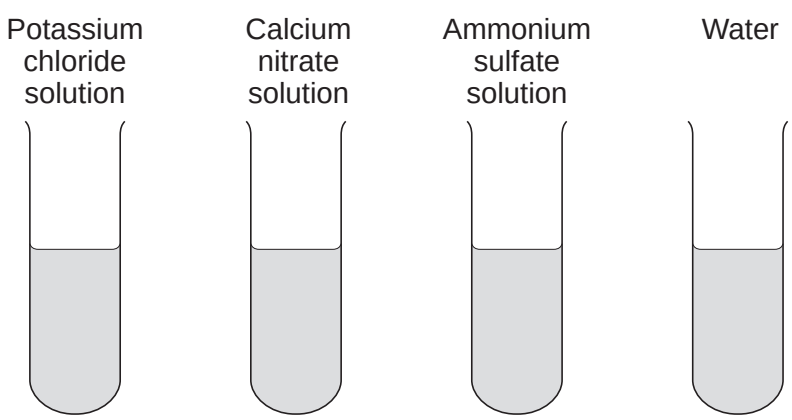
1 (a) (iii) Ethanoic acid is a carboxylic acid.
Complete the sentence.

[2 marks]

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

1 (b) **Figure 2** shows four test tubes containing three different salt solutions and water.

Figure 2



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 15 · 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	

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

1 (c) (i) Complete the following sentences.

[2 marks]

The flame colour for potassium ions is _____ .

The flame colour for calcium ions is _____ .

1 (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 16

June 2019 | 8462/2H | Original Q2

0 2 This question is about lithium carbonate.

Lithium carbonate is used in medicines.

Figure 2 shows a tablet containing lithium carbonate.

Figure 2



0 2 . 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 16 · continued

0 2 . 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 2 . 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 17

June 2025 | 8462/2H | Original Q6

0 6 A student analysed three solutions, **A**, **B** and **C**.

Each solution contained one ionic compound.

The student added a few drops of sodium hydroxide solution to solution **A**.

Solution **A** produced a white precipitate.

Aluminium ions produce a white precipitate with a few drops of sodium hydroxide solution.

0 6 . 1 Name **one other** metal ion which produces a white precipitate with a few drops of sodium hydroxide solution.

[1 mark]

_____

0 6 . 2 Describe how the student could confirm the presence of aluminium ions in solution **A**.

Give the result of the test.

[2 marks]

Test _____

_____

Result _____

_____

4.8.3.3 Carbonates

Question 17 · continued

The student tested solution **B** to identify the ions present.

0 6 . 3 The student did a flame test on solution **B**.

An orange-red flame was produced.

Write the symbol for the metal ion in solution **B**.

[1 mark]

0 6 . 4 The student added dilute nitric acid followed by silver nitrate solution to solution **B**.

A white precipitate was produced.

Write the symbol for the non-metal ion in solution **B**.

[1 mark]

Question 6 continues on the next page

4.8.3.3 Carbonates

The student added 1.0 mol/dm^3 nitric acid to solution **C**.

Bubbles of gas were produced.

0 6 . 5 Describe a test on the bubbles of gas that confirms that solution **C** contained carbonate ions.

Give the result of the test.

[2 marks]

Test _____

_____

Result _____

_____

0 6 . 6 The student repeated the test on solution **C** using 1.0 mol/dm^3 ethanoic acid instead of 1.0 mol/dm^3 nitric acid.

Bubbles of gas were produced more slowly using ethanoic acid.

Explain why.

[4 marks]

_____

_____

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