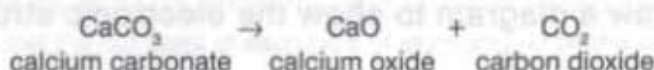


2.1 Limestone and its uses

Key points

- Limestone is made mainly of calcium carbonate.
- Limestone is used as a building material and to make calcium oxide and cement.
- Cement mixed with sand, aggregate and water makes concrete.
- Calcium carbonate decomposes when heated to make calcium oxide and carbon dioxide.

- We quarry large amounts of limestone rock because it has many uses.
- Blocks of limestone can be used for building. Limestone is used to make calcium oxide and **cement**.
- We make **concrete** by mixing cement with sand, aggregate and water.
- Limestone is mainly **calcium carbonate**, CaCO_3 .
- When heated strongly, calcium carbonate decomposes to make calcium oxide and carbon dioxide. This is done on a large scale in lime kilns. The equation for this reaction is:



- This type of reaction is called **thermal decomposition**.

1 List the ways in which limestone and products made from limestone are used in the building industry.



Examiner's tip

Thermal decomposition means 'breaking down by heating'. You need to make both points – 'breaking down' and 'by heating' – to get full marks.

Key words: cement, concrete, calcium carbonate, thermal decomposition

2.2 Reactions of carbonates

Key points

- Metal carbonates decompose when heated to produce the metal oxide and carbon dioxide.
- Carbonates react with acids to produce a salt, water and carbon dioxide.
- Carbon dioxide turns limewater cloudy.

- All metal carbonates react in similar ways when heated or when reacted with acids.
- Metal carbonates decompose to the metal oxide and carbon dioxide when they are heated strongly enough.
- A Bunsen burner flame cannot get hot enough to decompose sodium carbonate or potassium carbonate.

1 What are the products when zinc carbonate is heated strongly?

- All carbonates react with acids to produce a salt, water and carbon dioxide gas. Limestone is damaged by acid rain because the calcium carbonate in the limestone reacts with acids in the rain.
- Calcium hydroxide solution is called limewater. **Limewater** is used to test for carbon dioxide. The limewater turns cloudy because it reacts with carbon dioxide to produce insoluble calcium carbonate.

2 Write a word equation for the reaction of magnesium carbonate with hydrochloric acid.

Key word: limewater



The test for carbonates

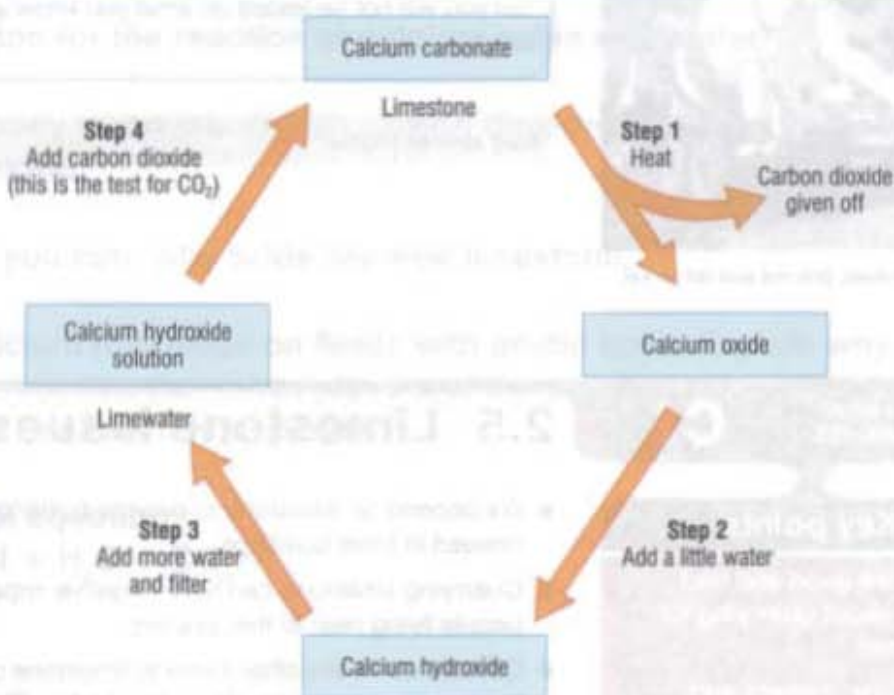
2.3 The 'limestone reaction cycle'

Key points

- Thermal decomposition of calcium carbonate produces calcium oxide and carbon dioxide.
- Calcium oxide reacts with water to produce calcium hydroxide.
- Calcium hydroxide is an alkali that can be used to neutralise acids.
- Calcium hydroxide reacts with carbon dioxide to produce calcium carbonate.

- When heated strongly the calcium carbonate in limestone decomposes to **calcium oxide** and carbon dioxide.
- When water is added to calcium oxide they react to produce **calcium hydroxide**.
- Calcium hydroxide is an alkali and so it can be used to neutralise acids. For example, it is used by farmers to neutralise acidic soils and in industry to neutralise acidic gases.
- Calcium hydroxide is not very soluble in water but dissolves slightly to make limewater.
- Calcium hydroxide reacts with carbon dioxide to produce calcium carbonate, the main compound in limestone.

1 Write word equations for the three reactions in the 'limestone cycle'.



The 'limestone reaction cycle'

Key words: calcium oxide, calcium hydroxide

Bump up your grade

If you are taking the Higher Tier paper, you should be able to write balanced symbol equations for the three reactions in the 'limestone cycle'.



St Paul's Cathedral in London is built from limestone blocks

2.4 Cement and concrete

Key points

- Cement is made by heating limestone with clay in a kiln.
- Mortar is made by mixing cement and sand with water.
- Concrete is made by mixing aggregate with cement, sand and water.



Concrete is mixed, poured and left to set

- To make cement, limestone is mixed with clay and heated strongly in a kiln. The product is ground up to make a fine powder.
- Cement is mixed with sand and water to make **mortar**. The mortar is used to hold bricks and blocks together in buildings.
- Concrete is made by adding aggregate to cement, sand and water. Small stones or crushed rock are used as aggregate. The mixture can be poured into moulds before it sets to form a hard solid.

1 What are the differences between cement, mortar and concrete?

AQA Examiner's tip

You should have studied developments in using limestone, cement and concrete but you will not be tested on what you know about these developments in the exam.

Key word: mortar

2.5 Limestone issues

Key points

- There are good and bad points about quarrying for limestone.
- Limestone, cement and concrete are needed as building materials.
- Quarrying and processing limestone and its products have negative impacts on the environment.

- We depend on limestone to provide building materials. Cement and concrete are needed in most buildings.
- Quarrying limestone can have negative impacts on the environment and on people living near to the quarries.
- Cement works are often close to limestone quarries. Making cement involves heating limestone with clay in large kilns. This uses a large area of land and a lot of energy.

- 1 Sort the following into advantages and disadvantages for an area in which limestone is to be quarried.
- More employment opportunities for local people
 - Dust and noise
 - More traffic
 - Loss of habitats for wildlife
 - More customers and trade for local businesses
 - Improved roads

AQA Examiner's tip

You may be given information in the examination about building materials or the processes needed to make them so that you can consider their positive benefits and the negative aspects of their production and use.

- 1 Which of these is the formula for the main compound in limestone?
CaCl₂, CaCO₃, CaSO₄, Ca(OH)₂
- 2 How is cement made?
- 3 Name the four substances used to make concrete.
- 4 What is meant by 'thermal decomposition' of a compound?
- 5 Name the products formed when calcium carbonate is heated strongly.
- 6 Write a word equation for the reaction of calcium oxide with water.
- 7 Limewater goes cloudy when mixed with carbon dioxide. Explain why, using an equation in your answer.
- 8 Explain, as fully as you can, why acids damage limestone.
- 9 Farmers spread calcium hydroxide on fields with acidic soils. Explain why, naming the type of reaction that takes place and the property of calcium hydroxide on which this reaction depends.
- 10 Balance this symbol equation:
 $K_2CO_3 + HCl \rightarrow KCl + H_2O + CO_2$

[H]

Chapter checklist



Tick when you have:

- reviewed it after your lesson
- revised once – some questions right
- revised twice – all questions right

Move on to another topic when you have all three ticks

Limestone and its uses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reactions of carbonates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The 'limestone reaction cycle'	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cement and concrete	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limestone issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>