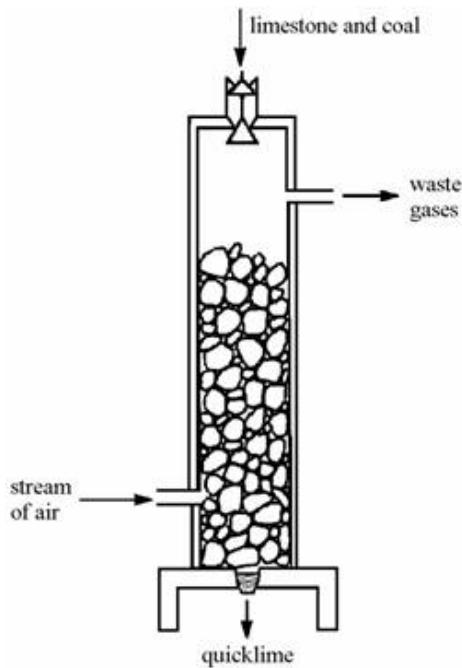


Q1. Limestone is an important raw material.

The diagram shows a lime kiln. The limestone is heated by the burning coal.



- (i) Suggest why hot air is blown into the lime kiln.

.....
.....

(1)

- (ii) Give **two** reasons why carbon dioxide is produced in the lime kiln.

Reason 1

.....
Reason 2

(2)
(Total 3 marks)

Q2. Limestone is an important raw material.

- (a) The main compound in limestone has the formula CaCO_3 .
Name the elements in this compound.

1

2

3

(2)

- (b) Limestone has many uses. Select from the list below **two** important materials made from limestone.

cement

diesel oil

glass

poly(ethene)

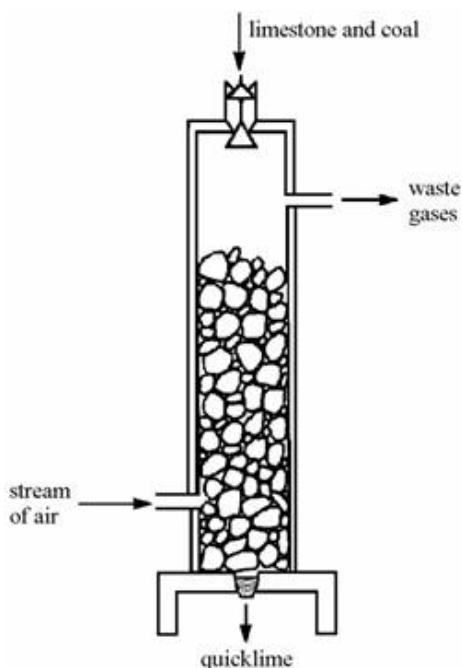
sodium hydroxide

sulphuric acid

..... and

(2)

- (c) The diagram shows a lime kiln. The limestone is heated by the burning coal.



- (i) Suggest why hot air is blown into the lime kiln.

.....

.....

(1)

- (ii) Give **two** reasons why carbon dioxide is produced in the lime kiln.

Reason 1

.....

Reason 2

.....

(2)

- (d) (i) Quicklime (calcium oxide) can be converted to slaked lime (calcium hydroxide) by adding water.

Write a word equation to represent this reaction.

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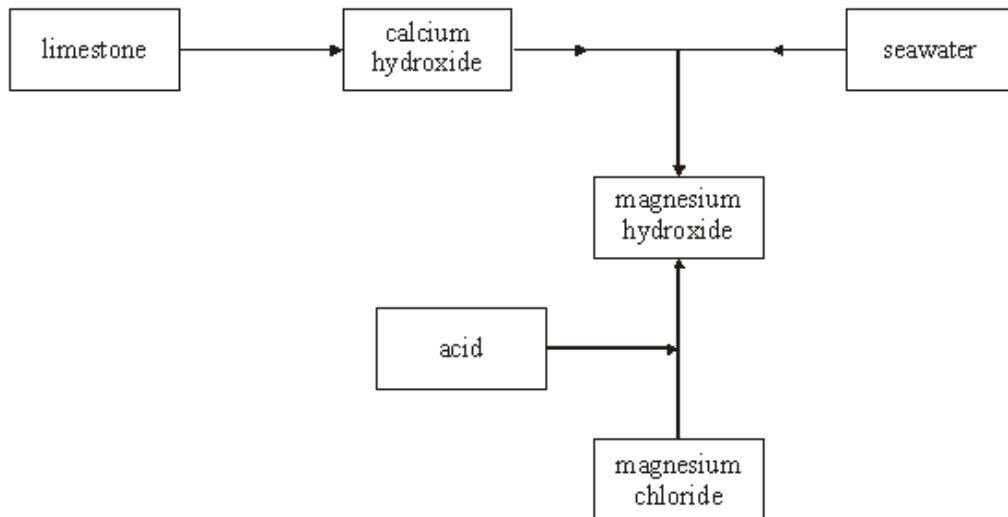
(1)

- (ii) Why do farmers sometimes add slaked lime to acidic soil?
-
-

(1)
(Total 9 marks)

- Q3.** Magnesium chloride is a useful salt.

The flow diagram shows how it can be made.



- (i) Describe how calcium hydroxide can be made from limestone.
-
-
-
-

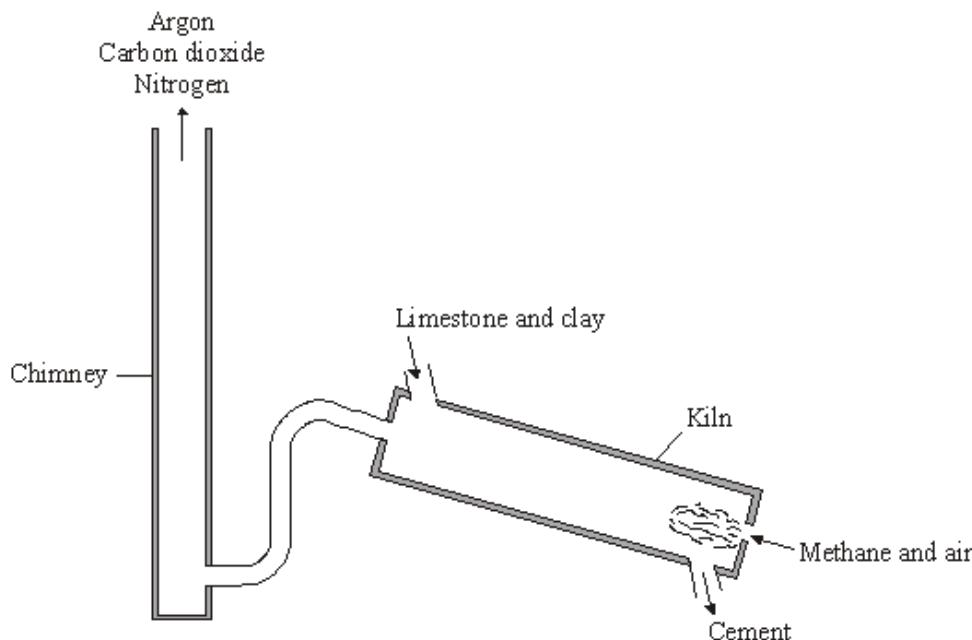
(2)

- (ii) Write a word equation for the neutralisation of magnesium hydroxide with a suitable acid to form magnesium chloride.
-

(2)
(Total 4 marks)

Q4. Limestone contains calcium carbonate, CaCO_3 .

At a cement works, limestone is mixed with clay and heated in a kiln.



- (a) (i) When methane is burned in this process the waste gases contain carbon dioxide and nitrogen.

Explain why.

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.....

(2)

- (ii) Complete the symbol equation for the thermal decomposition of calcium carbonate.



(2)

- (b) A different fuel is burnt at the cement works.

Suggest **one** reason the company may give for using this different fuel at the cement works.

.....
.....

(1)

- (c) The cement works continue to burn the different fuel.

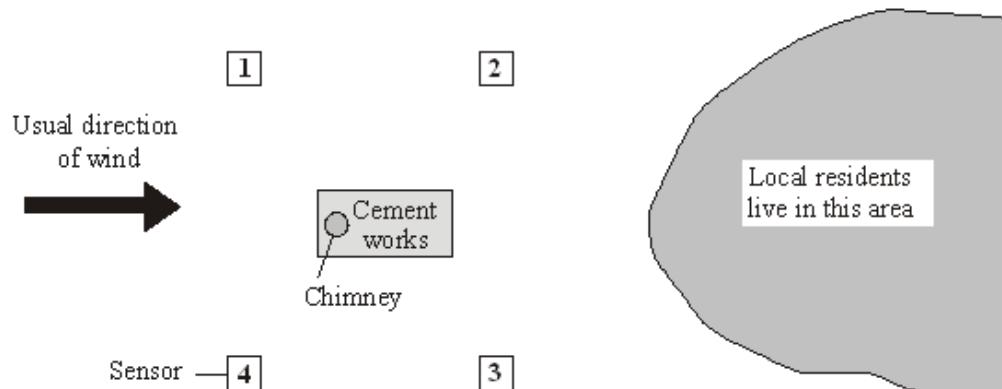
Local residents are concerned because more children are suffering asthma attacks. Residents have also noticed that parked cars are becoming dirty because of smoke particles from the chimney.

The table shows the possible medical risk from smoke particles.

Particle size in mm	Medical effect
Larger than 0.4	No medical risks known
0.3 and smaller	Causes asthma attacks
0.2 and smaller	May cause cancer

It is also recommended that to avoid damage to health, the concentration of any particles should be no higher than 2 parts per million (ppm).

Scientists were brought in to monitor the emissions from the cement work's chimney. They positioned four sensors around the cement works to monitor airborne smoke particles.



These four sensors only detect particle sizes larger than 0.5 mm and measure the concentration of particles in ppm. The scientists reported that the particle sensors showed that the average concentration of particles was 1.8 ppm. The scientists concluded that there was no risk to health.

- (i) Explain why the local residents objected to the positions of the four sensors.

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.....

(2)

- (ii) What evidence did the scientists use to conclude that there was no risk to health?

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(1)

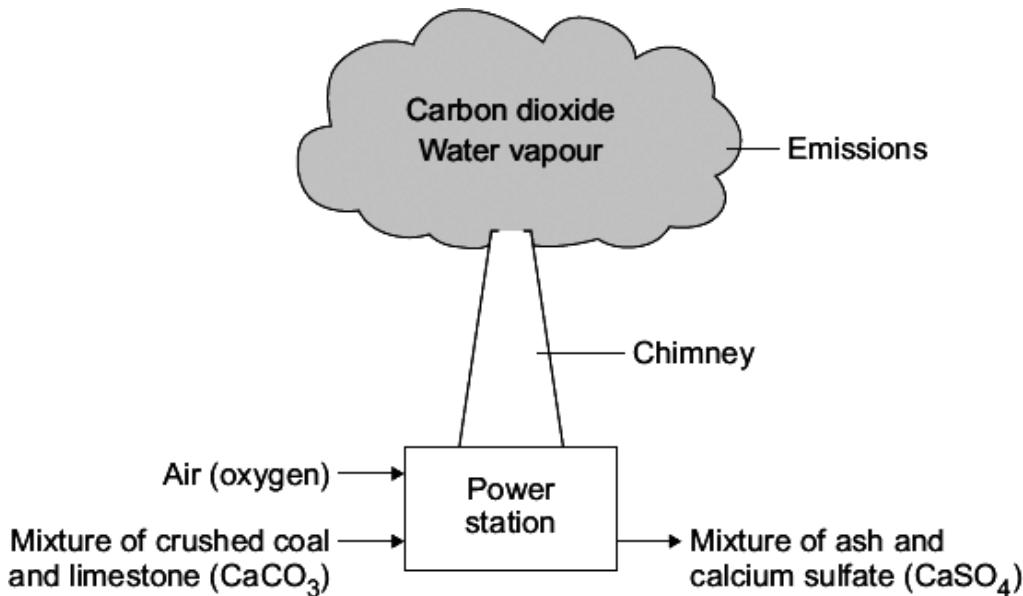
- (iii) The local residents were still concerned that there was a risk to health, even though the average concentration of particles was 1.8 ppm.

Explain why.

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(3)
(Total 11 marks)

- Q5.** Most power stations burn coal to generate electricity. Burning coal gives off sulfur dioxide gas which can be removed from the waste gases by using limestone. This prevents sulfur dioxide from entering the atmosphere and causing acid rain. One disadvantage of using limestone in a power station is that it releases 'locked up carbon dioxide' into the atmosphere.



- (a) How does the limestone used in a power station:

- (i) release carbon dioxide

.....

(1)

(ii) remove sulfur dioxide?

.....

.....

(1)

(b) The waste gases from the chimney are monitored. One toxic gas that should not be released is carbon monoxide.

Explain how carbon monoxide would be formed.

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(2)

(c) The use of limestone in a power station releases 'locked up carbon dioxide' into the atmosphere.

(i) Explain the meaning of 'locked up carbon dioxide'.

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(2)

(ii) Why does the release of this carbon dioxide cause an environmental problem?

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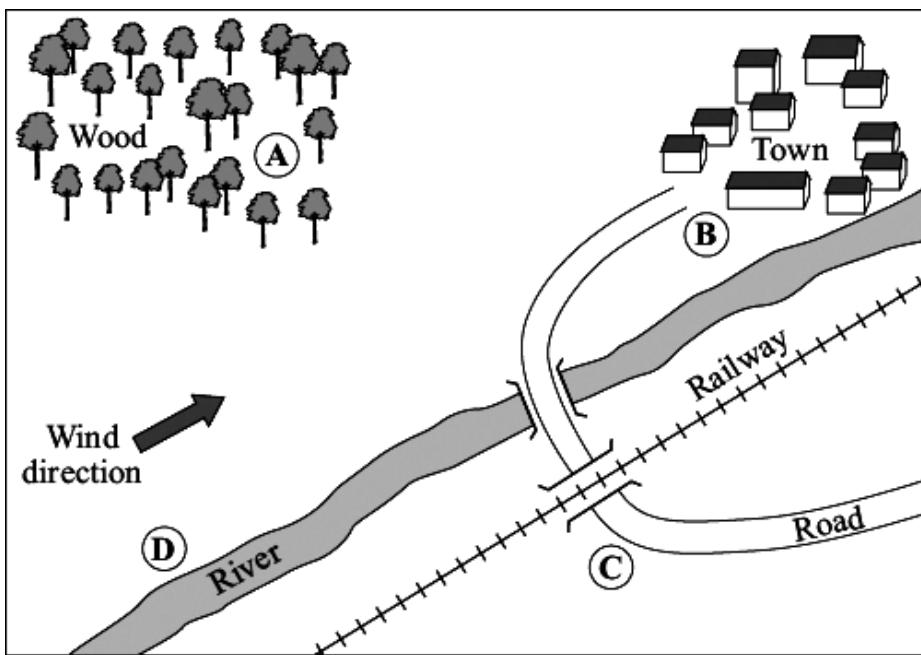
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(1)

(Total 7 marks)

- Q6.** A company wants to extract limestone from an area of natural beauty. The Government has granted permission for the company to take and analyse samples of limestone. The company selects four sites, **A**, **B**, **C** and **D**, within the area and takes four samples from each site.



- (a) The limestone is analysed by:

- heating 5 g of each sample for 30 minutes
- allowing the sample to cool in a dry, argon atmosphere
- weighing the solid remaining

The table shows the company's results.

Site	Mass of solid remaining in g			
	Sample 1	Sample 2	Sample 3	Sample 4
A	3.15	3.10	3.20	3.19
B	3.25	3.21	3.24	3.26
C	2.85	2.95	2.92	3.00
D	2.98	2.88	2.92	2.82

Limestone is a rock containing calcium carbonate, CaCO_3

If the limestone is pure calcium carbonate then the mass of solid remaining would be 2.80 g.

Why does the mass of limestone decrease when it is heated?

.....

(1)

- (b) Suggest and explain why the solid remaining was cooled in a dry, argon atmosphere.

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(2)

- (c) Which site, **A**, **B**, **C** or **D**, would you choose for extracting limestone?

Give the advantages **and** disadvantages for your chosen site.

You must explain why you chose this site.

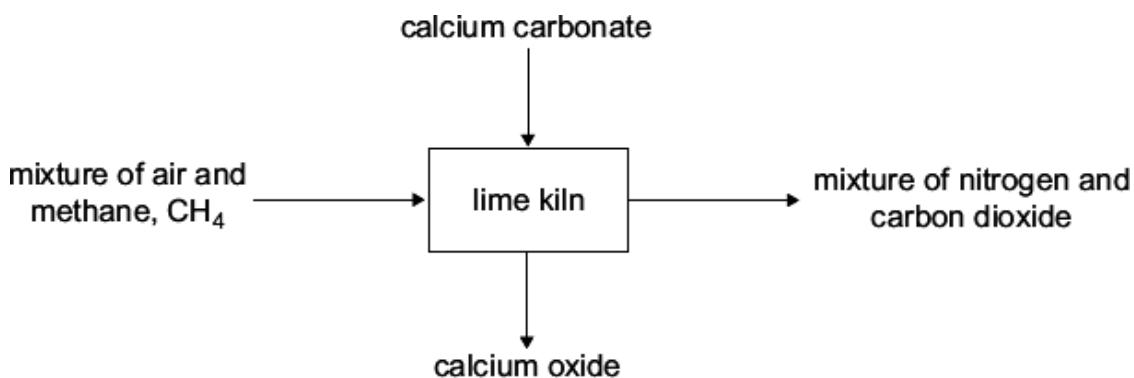
My chosen site is .

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(4)
(Total 7 marks)

Q7. Limestone is mainly calcium carbonate, CaCO_3

The flow diagram represents how calcium oxide (quicklime) is made when calcium carbonate (limestone) is heated in a lime kiln.



- (a) (i) How many elements is calcium carbonate, CaCO_3 , made from?

.....

(1)

- (ii) The main gases leaving the lime kiln are nitrogen and carbon dioxide.

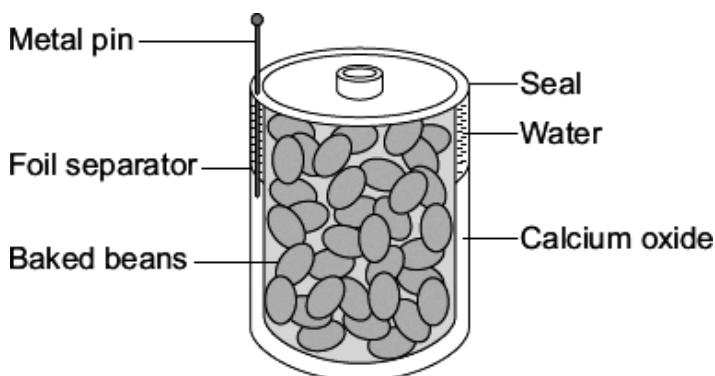
Explain why.

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(3)

- (b) Calcium oxide (quicklime) is used in self-heating cans.

The diagram shows a self-heating can made to warm baked beans.



To warm the baked beans the metal pin is pushed through the seal and foil separator. The foil separator breaks allowing water to mix with the calcium oxide (quicklime).

Describe what happens when water mixes with calcium oxide.

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(2)
(Total 6 marks)

Q8. Calcium carbonate is found in limestone.

Limestone is used as a building material.

Limestone is also used to make calcium oxide and calcium hydroxide.

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

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

.....

(1)

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

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(1)

- (b) Limestone reacts with acids.

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



(1)

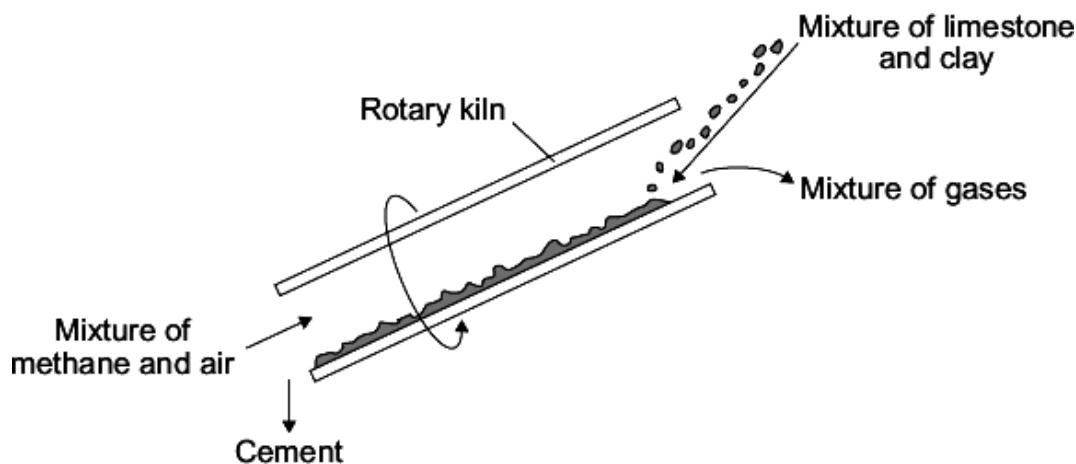
- (ii) Buildings made from limestone are affected by the products from burning fossil fuels containing sulfur.

Explain why.

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(2)

- (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.



- (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)

- (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

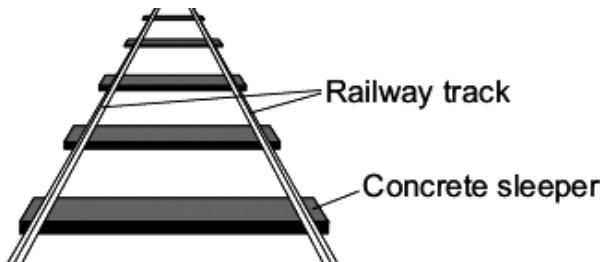
Reason

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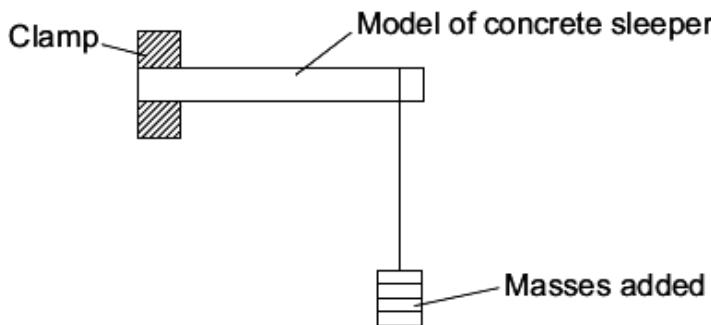
(2)
(Total 9 marks)

- Q9.** In the UK, railway sleepers were made from wood.
They are now often made from concrete.



A scientist was asked to find the best concrete mixture to use so that railway sleepers would not break easily. The scientist made:

- a mould to make small models of concrete sleepers
- concrete mixtures using crushed rock, sand, cement and water
- the equipment shown to add 0.1 kg masses until the model sleeper broke.



The scientist's results are shown in the table.

Concrete mixture in % by volume			Total mass added to break the model sleeper in kg				
Cement	Sand	Crushed rock	Test 1	Test 2	Test 3	Test 4	Mean
10	70	20	1.2	1.1	1.3	1.2	1.2
20	60	20	3.0	2.6	2.5	2.4	
30	50	20	3.5	3.3	3.3	3.3	3.3
40	40	20	3.9	3.8	4.0	3.3	3.9
50	30	20	4.2	4.5	4.2	4.3	4.3

- (a) Calculate the mean total mass added to break the model sleeper that has 20 % cement by volume.
-
.....

Mean = kg

(2)

- (b) State **one** conclusion that the scientist could make from these results.

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.....
.....

(1)

- (c) The scientist sent the results in a report to a company that makes full-size concrete railway sleepers.

- (i) Suggest **two** other factors that the company should take into consideration before deciding which mixture to use to make a full-size concrete railway sleeper.

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(2)

- (ii) The scientist's report claimed that using concrete sleepers instead of wooden sleepers would have less environmental impact.

Do you agree with the scientist's claim?

Use your knowledge and understanding to justify your answer.

Remember to compare using concrete with using wood for the sleepers.

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(4)
(Total 9 marks)

- Q10.** Limestone is used as a building material. Acid rain erodes limestone.

- (a) Limestone contains calcium carbonate.

The symbol equation for the reaction of calcium carbonate with hydrochloric acid is shown.



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

Give the result of the test.

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(2)

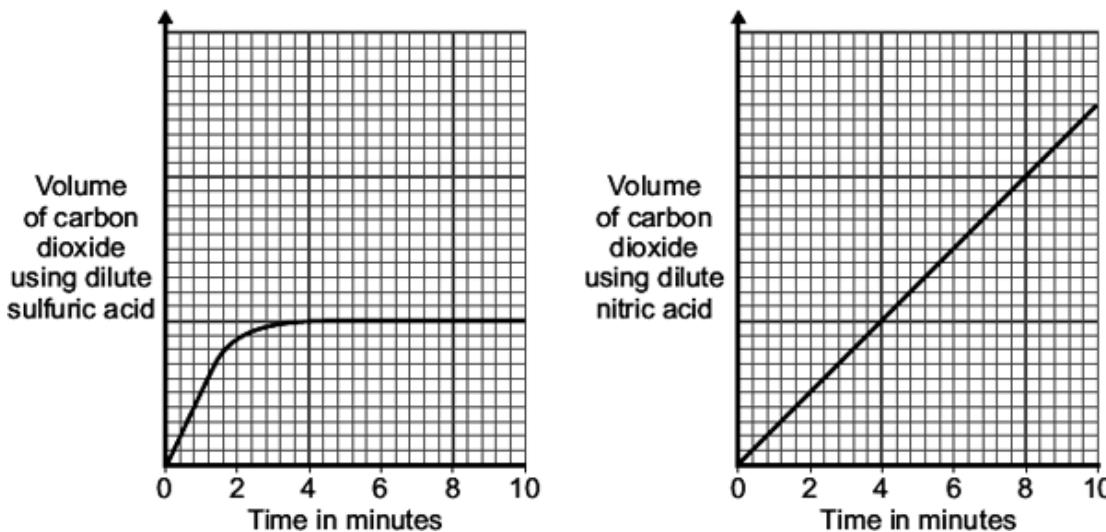
- (b) Gases from vehicle exhausts produce sulfuric acid and nitric acid.

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.



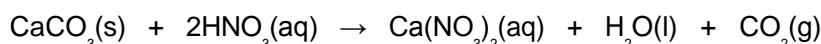
- (i) State **two** variables that must be kept the same for this investigation.

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.....

(2)

- (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.



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

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(3)
(Total 7 marks)

- Q11.** 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.

- (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.

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



(2)

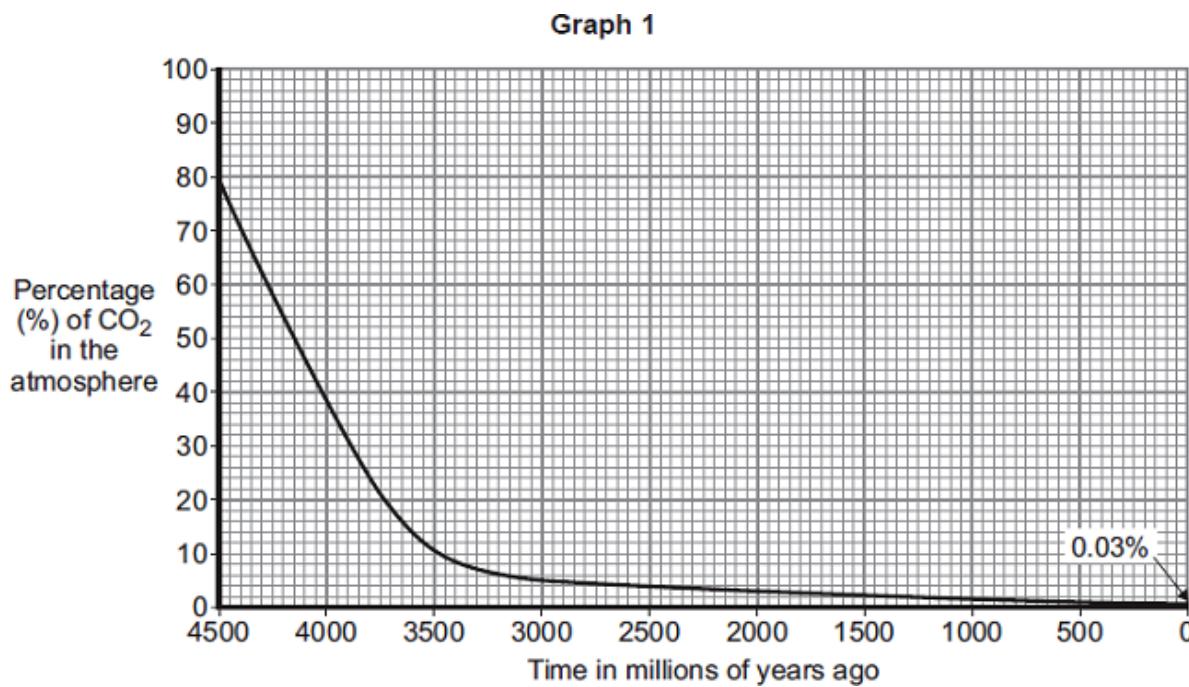
- (ii) Hydrocarbons and calcium carbonate contain *locked up* carbon dioxide.

What is *locked up* carbon dioxide?

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.....
.....

(2)

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



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

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

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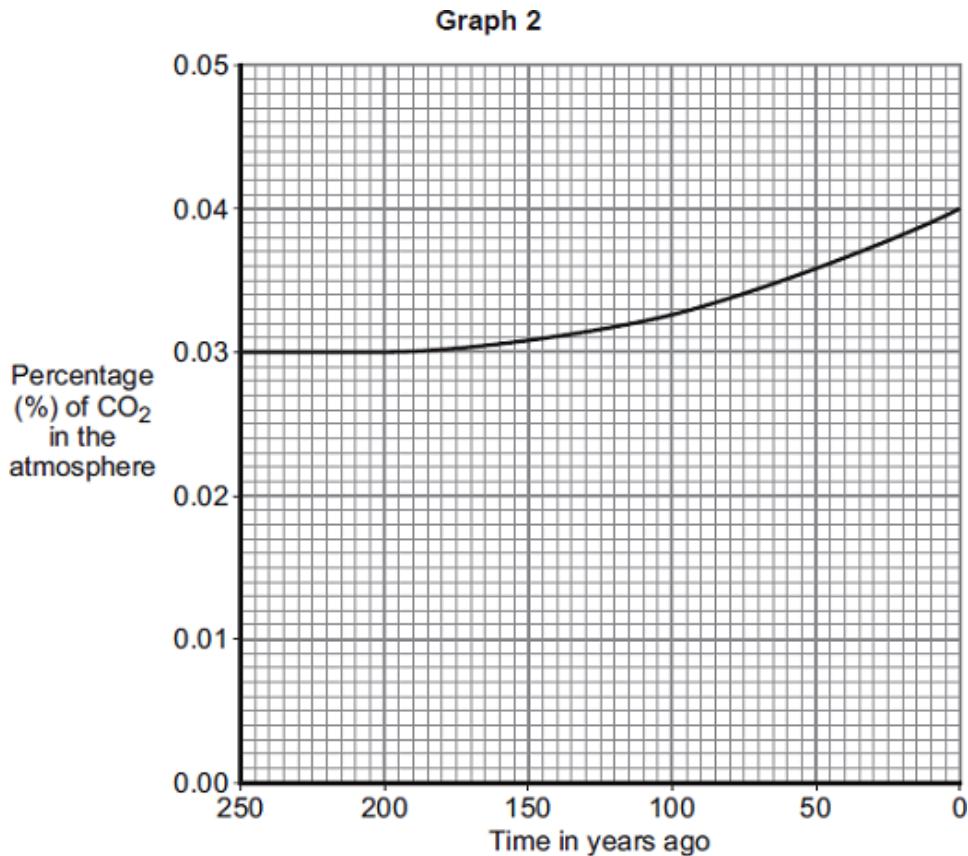
(2)

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

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.....
.....

(2)

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



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

Explain your answer.

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(2)
(Total 10 marks)

