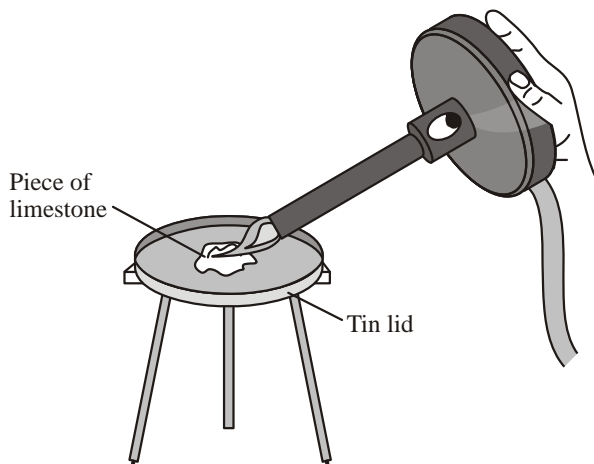


Limestone and building materials

1. Limestone is a useful rock.

(a) A student did some experiments to study limestone.

In one experiment, a piece of limestone was heated very strongly as shown in the diagram.



Suggest **one** safety precaution that the student should take when doing this experiment.

.....

(1)

(b) The student did another experiment using 2.00 grams of limestone. The limestone was weighed before and after being heated. The student then repeated this experiment. A new sample of 2.00 grams of limestone was used.

The results are shown in the table.

	Experiment 1	Experiment 2
Mass of limestone before heating in grams (g)	2.00	2.00
Mass of limestone after heating in grams (g)	1.12	1.10
Mass lost in grams (g)	0.88	0.90

(i) Calculate the average mass lost for the two experiments.

.....

Average mass lost = g

(1)

(ii) Explain why it was important for the student to repeat this experiment.

.....

(1)

(iii) Suggest why the mass lost was not the same for the two experiments.

.....
.....

(1)

(iv) Explain why a balance which measures to the nearest 0.1 g would **not** be suitable for this experiment.

.....
.....

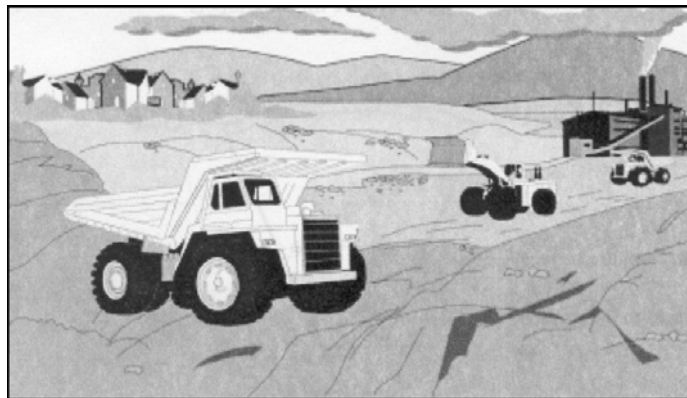
(1)

(v) Suggest what mass of carbon dioxide would be produced when 2.00 g of limestone is heated.

Mass of carbon dioxide produced =g

(1)

(c) The drawing shows a limestone quarry.



(i) Suggest **two** ways in which the limestone quarry may harm the environment.

1
.....
2
.....

(2)

(ii) Suggest **two** ways in which the limestone quarry is of benefit to people.

1
.....
2
.....

(2)

(Total 13 marks)

2. Limestone is mainly calcium carbonate.

(a) Quicklime is produced by heating limestone.

(i) Complete the word equation for this reaction by writing the chemical name of the solid and the gas produced.

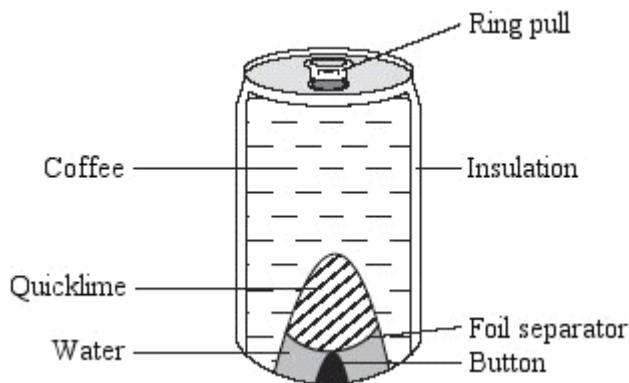
calcium carbonate → + (2)

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

..... (1)

(b) Quicklime is used in self-heating cans.

The diagram shows a self-heating can designed to raise the temperature of coffee to 60 °C.



The button on the base of the can is pushed. The foil separator breaks, allowing water to mix with the quicklime. After about 3 minutes, the can is opened by the ring pull. Insulating materials are used inside the walls of the can to prevent either the lips or the fingers from being burned.

(i) Explain why the coffee becomes hot.

.....

 (2)

(ii) Suggest **two** reasons why it is **not** possible to re-use this self-heating can.

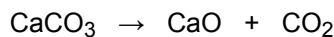
1

 2

(2)
 (Total 7 marks)

3. (a) Limestone is a hard rock that is used as a building material. Limestone was used by the Egyptians to make plaster.

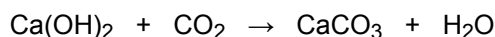
Reaction 1 – calcium carbonate, CaCO₃, was decomposed by heating limestone



Reaction 2 – water was added to the solid produced to make slaked lime



Reaction 3 – a mixture of slaked lime and water was used as plaster. After the plaster had set it became even harder with age



- (i) Name the solid formed when calcium carbonate decomposed.

.....

(1)

- (ii) Use the reactions to explain how the plaster became even harder with age.

.....

(3)

- (b) A gardener wanted to make a step up to his greenhouse door. He decided to use a mixture of cement and sand to make mortar.

He experimented using mixtures with different cement to sand ratios.

- The mortar mixtures were put in the same sized mould.
- Each mortar mixture was allowed to set hard.
- He then dropped a metal ball from increasing heights until the set mortar cracked.
- He recorded his results in a table.

Volume of sand in cm ³	Volume of cement in cm ³	Height the metal ball dropped to crack the set mortar in cm
800	100	17
700	100	24
600	100	30
500	100	36
400	100	37
300	100	48
200	100	54

(i) What is the relationship between the volume of sand and the strength of the mortar?

.....

(1)

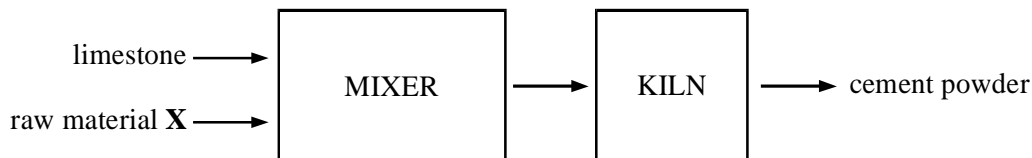
(ii) The gardener was not sure about some of his results.
 Use the results to explain why.

.....

(2)

(Total 7 marks)

4. Portland cement was invented by Joseph Aspdin, a builder from Leeds. The flow diagram shows how cement is made.



(a) (i) Name the raw material X used to make cement.

.....

(1)

(ii) In the kiln the raw materials are heated to about 1500°C.
 The limestone (calcium carbonate) is broken down at this temperature.
 Complete the word equation for this reaction.

calcium carbonate → + carbon dioxide

(1)

(iii) Suggest **one** major cost of this process other than the cost of the raw materials.

.....

(1)

(b) Cement can be used to make concrete.
 Name **two** substances that must be mixed with cement to make concrete.

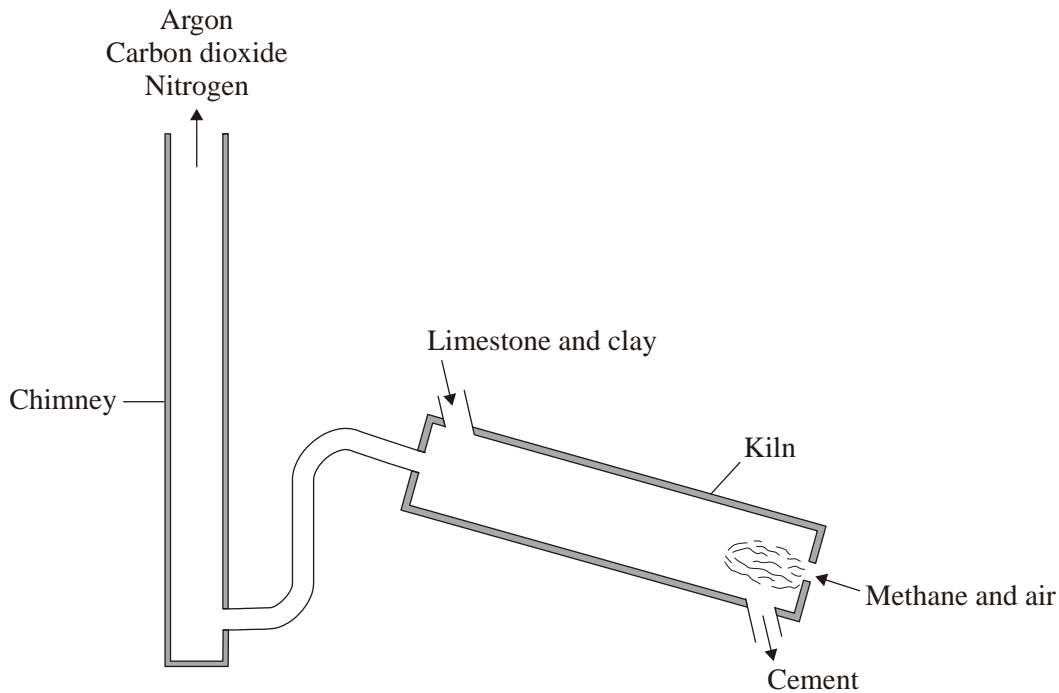
1

2

(2)

(Total 5 marks)

5. 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.

.....

.....

.....

.....

(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.

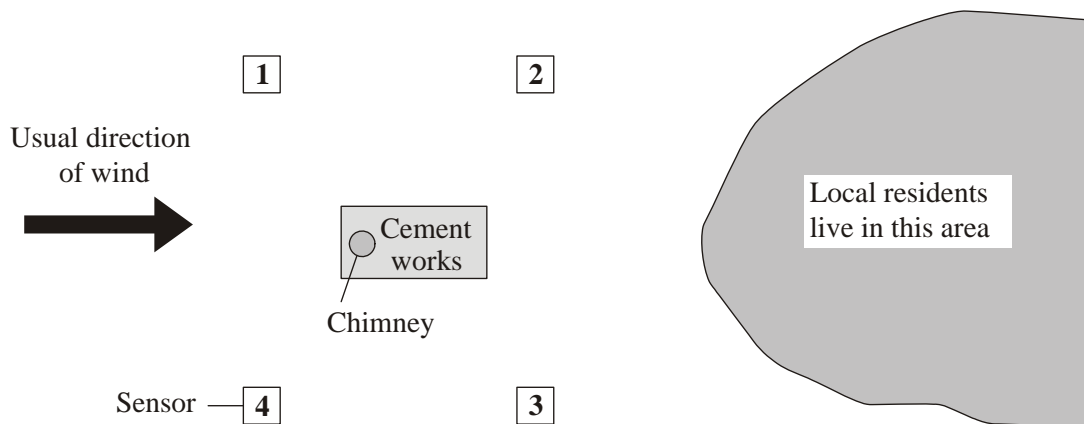
Local residents are concerned because more children are suffering asthma attacks. Residents have also noticed that parked cars are becoming dirty because of smoke particles from the chimney.

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.

.....

.....

.....

(2)

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

.....

.....

(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.

.....

.....

.....

.....

.....

.....

(3)
(Total 11 marks)