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Student number

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# GCSE CHEMISTRY

Topic Paper: 9 Pollution, carbon dioxide and methane as greenhouse gases  
(Chemistry of the atmosphere)

Part 1

Time allowed: 35 minutes

## Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

## Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

## Information

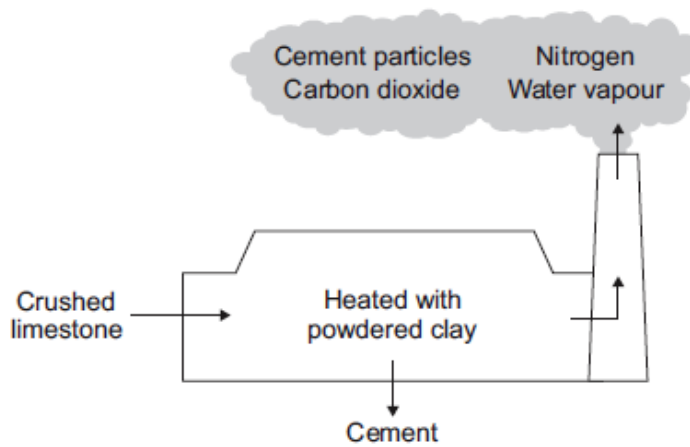
- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.



**30 Marks**



**Q1.** The diagram shows some of the substances used and produced at a cement works.



(a) Limestone is mainly calcium carbonate ( $\text{CaCO}_3$ ).

Write the correct answer in each box.

(i) The formula shows that calcium carbonate ( $\text{CaCO}_3$ ) contains  different elements.

(1)

(ii) The total number of atoms in the formula  $\text{CaCO}_3$  is .

(1)

(b) Name **one** of the substances produced at the cement works that causes atmospheric pollution.

State **one** effect of this atmospheric pollution.

Name .....

Effect .....

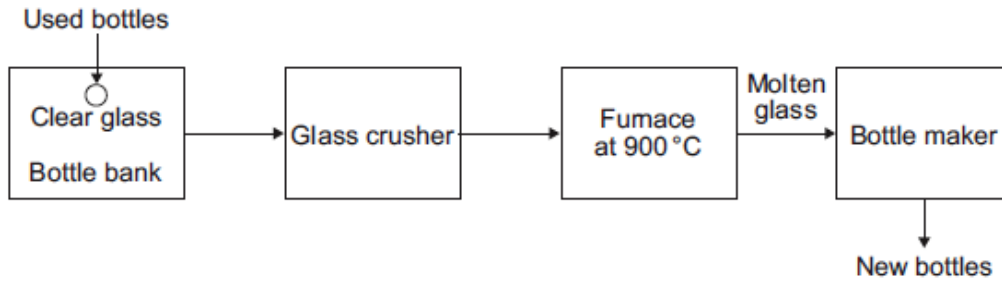
.....

.....

(2)



- (c) Limestone is used to produce glass bottles.  
 In recent years we have become more aware of the need to recycle glass bottles. Used glass bottles can be recycled if they are put into bottle banks.



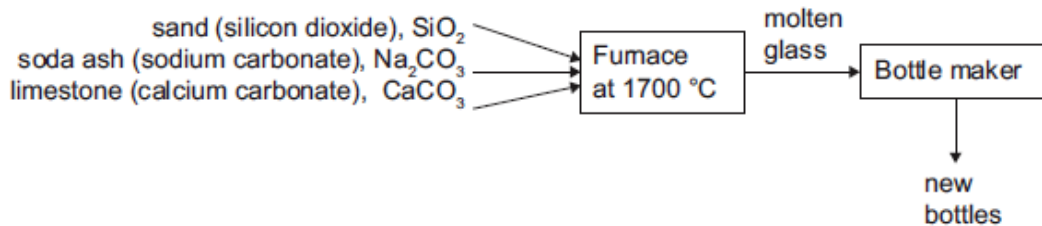
- (i) Suggest **two** reasons why light bulbs should **not** be put into bottle banks.

1 .....

2 .....

(2)

- (ii) New glass bottles can also be produced by heating a mixture of raw materials:



Suggest **two** environmental reasons why we should recycle glass bottles to make new glass bottles.

1 .....

.....

2 .....

.....

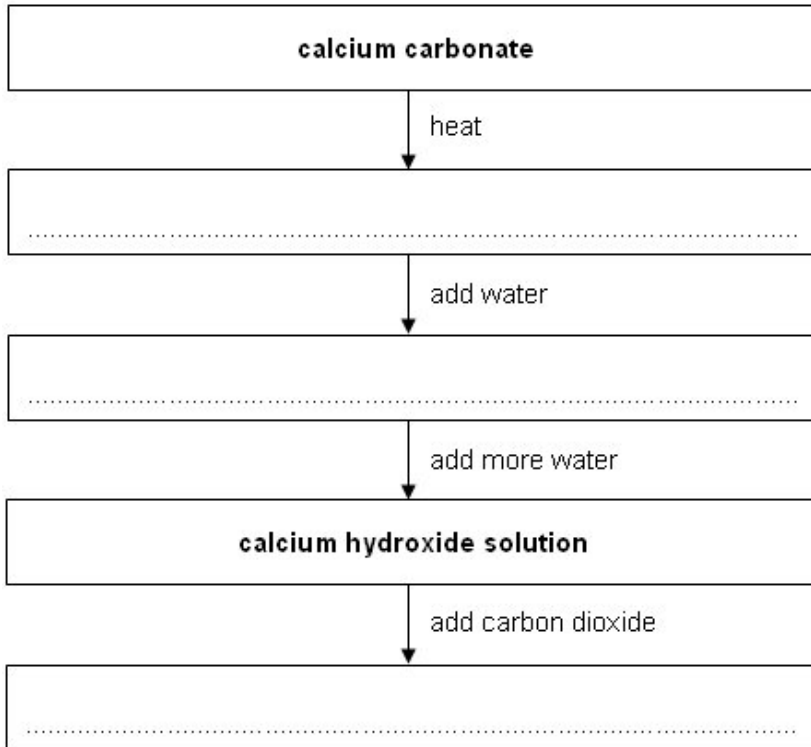
(2)  
(Total 8 marks)



**Q2.** Limestone contains calcium carbonate,  $\text{CaCO}_3$

(a) The flow chart shows the stages in the *limestone cycle*.

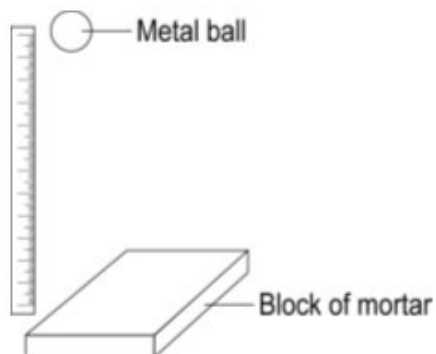
Write the name of the correct calcium compound in each empty box to complete the flow chart.



(3)

(b) Limestone is heated with clay to make cement.  
Cement is mixed with sand to make mortar.

A student investigated the strength of six mortar mixtures. Each mortar mixture contained  $100\text{cm}^3$  cement but each contained a different volume of sand.





To do the investigation the student:

added and stirred water into each mortar mixture

put each mixture into the same sized moulds

left each mixture to set hard

dropped a metal ball from increasing heights until the mortar cracked

recorded the results in a table.

Volume of sand in cm <sup>3</sup>	Volume of cement in cm <sup>3</sup>	Height the metal ball was dropped from to crack the mortar in cm
700	100	24
600	100	30
500	100	36
400	100	37
300	100	48
200	100	54

(i) What happens to the strength of the mortar as the volume of sand increases?

.....

(1)

(ii) The student was worried about an anomalous result.

Which result was anomalous?

Volume of sand = ..... cm<sup>3</sup>

Explain why you have chosen this result.

.....  
.....  
.....  
.....

(2)



(c) The student repeated the investigation but used six concrete mixtures.

From the results the student concluded correctly that concrete was stronger than mortar.

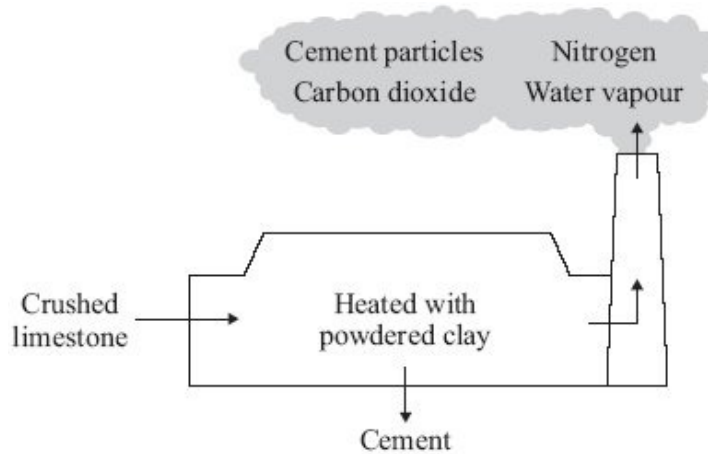
Suggest **one** reason why concrete is stronger than mortar.

.....  
.....

(1)  
(Total 7 marks)

**Q3.** A limestone quarry is in an area of natural beauty and near several villages.  
The company operating the quarry wants planning permission to build a new cement works in the quarry.

The diagram shows some of the substances used and produced at a cement works.



(a) Limestone is mainly calcium carbonate,  $\text{CaCO}_3$ .  
Write the correct number in the box to complete each sentence.

(i) The formula shows that calcium carbonate,  $\text{CaCO}_3$ ,

contains  different elements.

(1)

(ii) Calcium carbonate,  $\text{CaCO}_3$ , contains a total number of  atoms.

(1)



- (b) The company wants the new cement works because the nearest cement works is 100 km from the quarry. The company argues that a new cement works sited inside the quarry would reduce carbon dioxide emissions.

Suggest why the new cement works might reduce carbon dioxide emissions.

.....  
.....  
.....

(1)

- (c) Residents from the villages near the quarry are concerned that there will be atmospheric pollution from the new cement works.

- (i) Name and explain how **one** of the emissions from the chimney causes atmospheric pollution.

Name of emission: .....

Explanation: .....

.....

(2)

- (ii) Suggest what the company could do to reduce this atmospheric pollution.

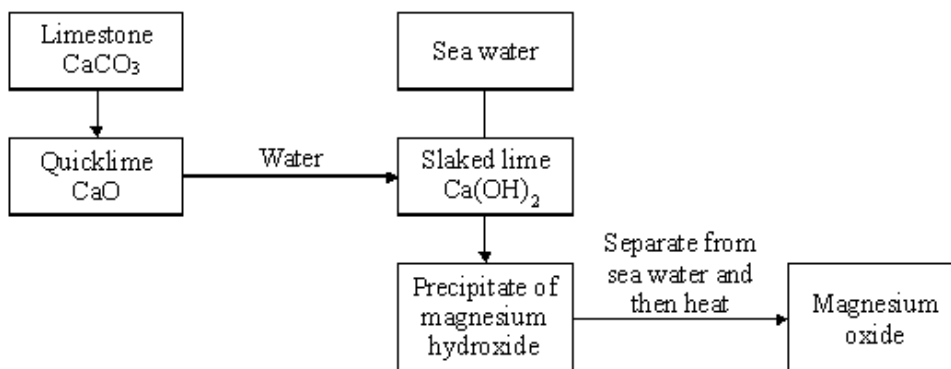
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(1)

(Total 6 marks)

**Q4.** Sea water contains magnesium ions. Magnesium oxide can be obtained from sea water using the following process.



(a) State the chemical name for limestone.

.....

(1)

(b) Write a word equation for the action of heat on limestone.

.....

(2)

(c) State the chemical name for slaked lime.

.....

(1)

(d) Write a balanced chemical equation for the addition of water to quicklime.

.....

(2)

(e) How can magnesium hydroxide be separated from sea water?

.....

(1)

(f) Suggest and explain how magnesium could be obtained from magnesium oxide.

.....

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(2)  
(Total 9 marks)