

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use
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General Certificate of Secondary Education  
June 2009



**SCIENCE B**  
**Unit Chemistry C1**

**CHY1H**  
**H**

**CHEMISTRY**  
**Unit Chemistry C1**

**Higher Tier**

Wednesday 17 June 2009 9.00 am to 9.45 am

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>a ruler.</li> </ul> <p>You may use a calculator.</p>
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Time allowed: 45 minutes

**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. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

**Information**

- The maximum mark for this paper is 45.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

**Advice**

- In all calculations, show clearly how you work out your answer.

For Examiner's Use			
Question	Mark	Question	Mark
1		3	
2		4	
		5	
		6	
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			

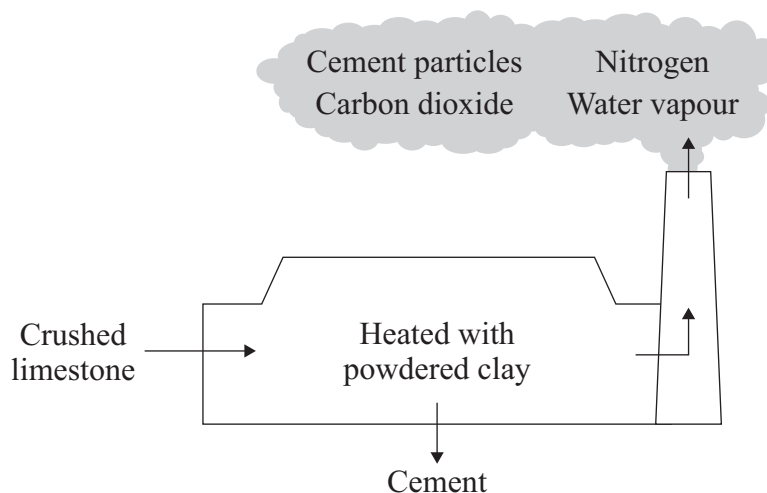


J U N O 9 C H Y 1 H O 1

Answer **all** questions in the spaces provided.

- 1 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.



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

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

contains  different elements.

(1 mark)

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

(1 mark)



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.

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.....  
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(1 mark)

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

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

Name of emission: .....

Explanation: .....

.....  
(2 marks)

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

.....  
.....

(1 mark)

6

**Turn over for the next question**

**Turn over ▶**



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

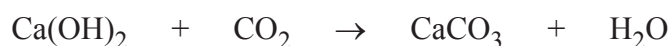
**Reaction 1** – calcium carbonate,  $\text{CaCO}_3$ , was decomposed by heating limestone



**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



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

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(1 mark)

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

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(3 marks)



- 2 (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 <sup>3</sup>	Volume of cement in cm <sup>3</sup>	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

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

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 .....

(1 mark)

- 2 (b) (ii) The gardener was not sure about some of his results.

Use the results to explain why.

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(2 marks)

7
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Turn over ►



- 3 There are many ideas about the formation of the Earth and its atmosphere from a molten ball of rock and minerals.
- 3 (a) One idea is that the Earth's early atmosphere and average surface temperature were probably like that of Venus today.

The table shows information about the Earth and Venus today.

Name of gas	Percentage composition of atmosphere	
	Earth today	Venus today
Nitrogen	78	3.5
Oxygen	21	a trace
Argon	0.97	a trace
Carbon dioxide	0.03	96.5
<b>Average surface temperature</b>	20°C	460°C

There is a variable amount of water vapour in both atmospheres.

- 3 (a) (i) How was the Earth's early atmosphere formed?

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 .....  
 (1 mark)

- 3 (a) (ii) The Earth's average surface temperature decreased over time. At what temperature would oceans have started to form?

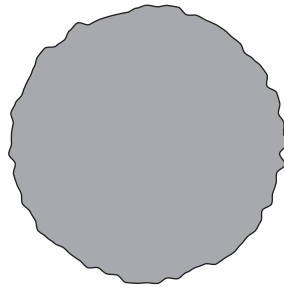
Temperature = ..... °C  
 (1 mark)

- 3 (a) (iii) Describe how the evolution of plants changed the Earth's atmosphere.

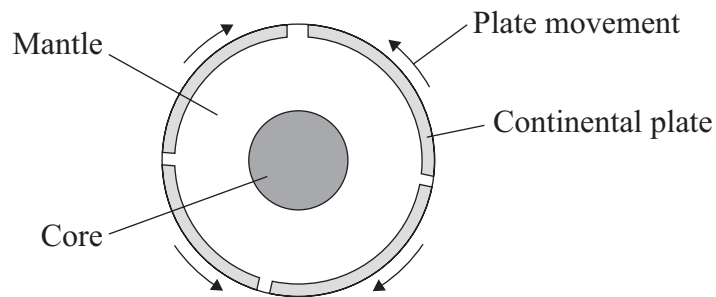
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 (2 marks)



- 3 (b) Another idea was that the Earth's mountains and continents formed in fixed positions as the molten ball of rock and minerals cooled and wrinkled.



Wegener, in 1915, had the idea that the Earth's crust and the upper part of the mantle had cracked into plates that were able to move. His idea meant that the mountains and continents were not in fixed positions.



- 3 (b) (i) Give **one** piece of evidence that led to Wegener's idea being accepted.

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(1 mark)

- 3 (b) (ii) Describe what causes the Earth's tectonic plates to move.

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(3 marks)

8
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Turn over ▶



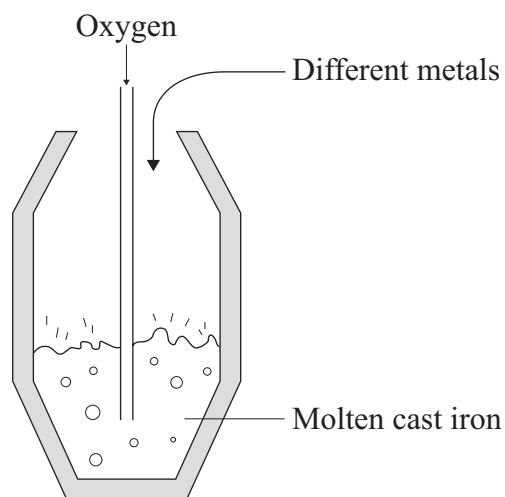
4 The demand for iron and steel is high.

4 (a) Iron that is extracted from its oxide by carbon reduction in a blast furnace is called cast iron. Cast iron contains about 4% carbon. This carbon makes cast iron very brittle.

Carbon steels can be made by the following processes.

- Blowing oxygen into molten cast iron to remove most of the carbon.
- Adding a calculated amount of carbon.

Sometimes different metals may also be added to the molten carbon steels.



4 (a) (i) Suggest how blowing oxygen into molten cast iron removes most of the carbon.

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(2 marks)

4 (a) (ii) Why are different metals sometimes added to molten carbon steels?

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(1 mark)





- 4 (b) The percentage of iron and steel recycled in the UK has been increasing.

Year	% iron and steel recycled
1998	25
2000	35
2002	42
2004	46
2006	57

The UK government has set targets for the percentage of iron and steel to be recycled. In 2006 the target was exceeded.

Suggest **two** reasons why the UK government wants to encourage recycling of iron and steel.

- 1 .....
- .....
- 2 .....
- .....

(2 marks)

5
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**Turn over for the next question**

**Turn over ►**



- 5 Margarine is manufactured using 'hard' plant oils. A margarine company tested several plant oils to determine their hardness for use in its margarine.

In the test iodine solution was used to find the iodine value. The units are grams of iodine that react with 100 g of oil.

Plant oils with lower iodine values are harder and are less unsaturated.

Plant oil	Melting point in °C	Iodine value
Coconut	25	10
Palm	35	54
Olive	-6	81
Castor	-18	85
Peanut	3	93
Rapeseed	-10	98
Sunflower	-17	125
Soya bean	-16	130

- 5 (a) Do the results in the table indicate that there is a relationship between the melting point of a plant oil and its hardness?

Explain your answer.

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(2 marks)



- 5 (b) The company stated that some of the plant oils were brown and that this may have affected the results.

Explain why the company considered the colour of plant oils to be a problem with this test.

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(2 marks)

- 5 (c) A consumer group stated that the test should not be carried out by the margarine company but by independent scientists.

Explain why.

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(2 marks)

- 5 (d) The company intends to use sunflower oil to make its margarine.

Explain how the company could process the sunflower oil to make it suitable for the manufacture of margarine.

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(3 marks)

9

Turn over ►



6 (a) PEX is a material that is used as an alternative to copper for hot water pipes. PEX is made from poly(ethene).

6 (a) (i) Describe how ethene forms poly(ethene).

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(2 marks)

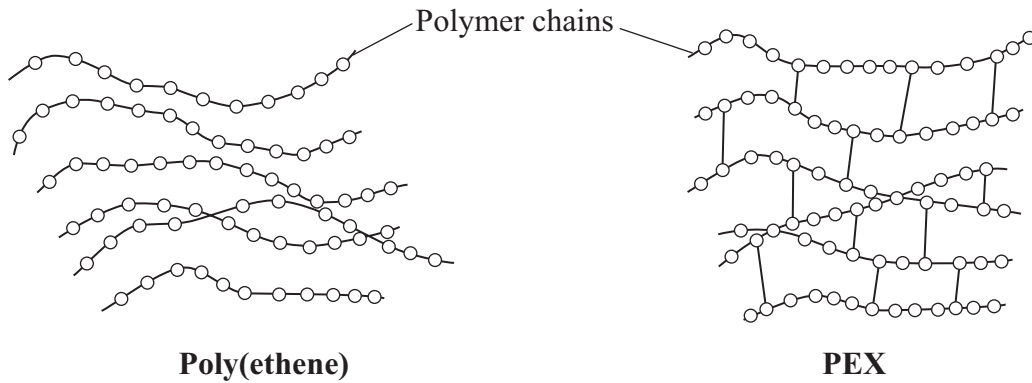
6 (a) (ii) PEX is a shape memory polymer. What property does a shape memory polymer have?

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(1 mark)

6 (a) (iii) The simplified structures of poly(ethene) and PEX are shown.



Poly(ethene) is a thermoplastic that softens easily when heated.

Suggest and explain how the structure of PEX changes this property.

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(3 marks)



- 6 (b) Copper was considered to be the most suitable material to use for hot water pipes. PEX is now used as an alternative material for hot water pipes.

Copper is extracted from its ore by a series of processes.

- 1 The low-grade ore is powdered and concentrated.
- 2 Smelting is carried out in an oxygen flash furnace. This furnace is heated to 1100°C using a hydrocarbon fuel. The copper ore is blown into the furnace with air, producing impure, molten copper.
- 3 Oxygen is blown into the impure, molten copper to remove any sulfur. The copper is cast into rectangular slabs.
- 4 The final purification of copper is done by electrolysis.

PEX is made from crude oil by a series of processes.

- 1 Fractional distillation
- 2 Cracking
- 3 Polymerisation
- 4 Conversion of poly(ethene) into PEX

Suggest the possible environmental advantages of using PEX instead of copper for hot water pipes.

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(4 marks)

10

**END OF QUESTIONS**



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