Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
January 2009

SCIENCE B **CHY1H**
Unit Chemistry C1

H

CHEMISTRY
Unit Chemistry C1

Higher Tier

Thursday 15 January 2009 1.30 pm to 2.15 pm

For this paper you must have:
- a ruler.

You may use a calculator.

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			

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

1 Water sold in plastic bottles has a high 'carbon cost'.

The 'carbon cost' depends on the amount of carbon dioxide emitted in making and transporting the product.

The more carbon dioxide emitted, the higher the 'carbon cost'.

1 (a) Plastic water bottles are made from a polymer.
The polymer is made from ethene.
Ethene is made by cracking hydrocarbons.

1 (a) (i) Name the polymer made from ethene.

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(1 mark)

1 (a) (ii) Ethene can be made by cracking the hydrocarbon pentane, C_5H_{12}.

$$C_5H_{12} \rightarrow C_2H_4 + C_3H_8$$

Explain why there is a 'carbon cost' for the process of cracking a hydrocarbon.

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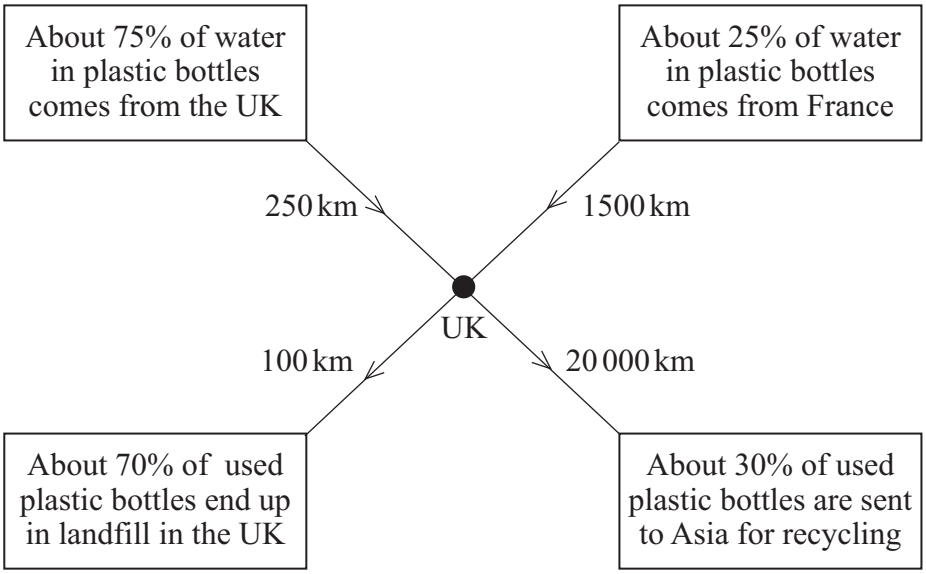
(2 marks)

1 (b) The diagram shows information about water sold in plastic bottles in the UK. The diagram also shows the average distances that water and plastic bottles are transported.



Suggest how the high 'carbon cost' of water sold in plastic bottles could be reduced.

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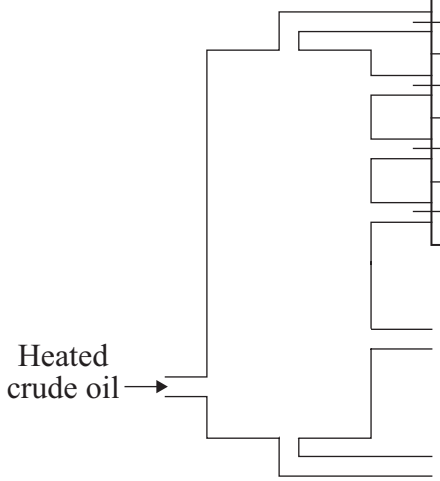
(3 marks)

6

Turn over for the next question

2 Crude oil is a resource from which fuels can be separated.

2 (a) The name of the main fuel fractions and one of the hydrocarbons in each fraction are shown in the table.



Main fuel fraction	A hydrocarbon in this fraction	Boiling point of hydrocarbon in °C
Gases	Propane, C_3H_8	−42
Petrol	Octane, C_8H_{18}	126
Paraffin	Dodecane, $C_{12}H_{26}$	216
Diesel	Eicosane, $C_{20}H_{42}$	344

2 (a) (i) How does the number of carbon atoms in a hydrocarbon affect its boiling point?

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(1 mark)

2 (a) (ii) Suggest the lowest temperature to which crude oil needs to be heated to vaporise all the hydrocarbons in the table.

Temperature = ... °C

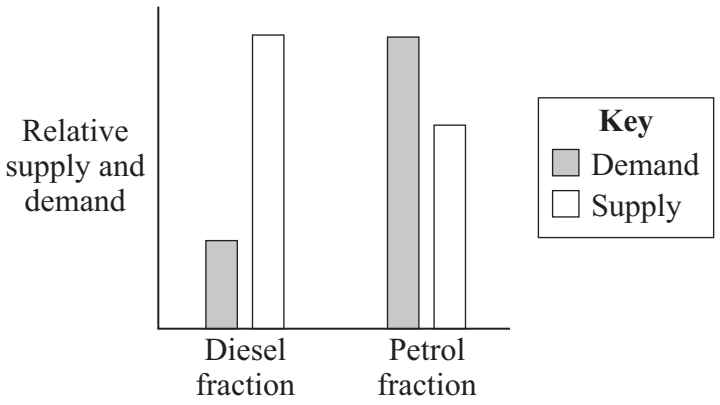
(1 mark)

2 (a) (iii) Dodecane boils at 216 °C. At what temperature will dodecane gas condense to liquid?

Temperature = ... °C

(1 mark)

2 (b) The bar chart shows the relative supply and demand for the petrol and diesel fractions.



2 (b) (i) How does the relative supply and demand for petrol and diesel fractions cause problems for an oil company?

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(2 marks)

2 (b) (ii) Suggest **one** way an oil company could solve these problems.

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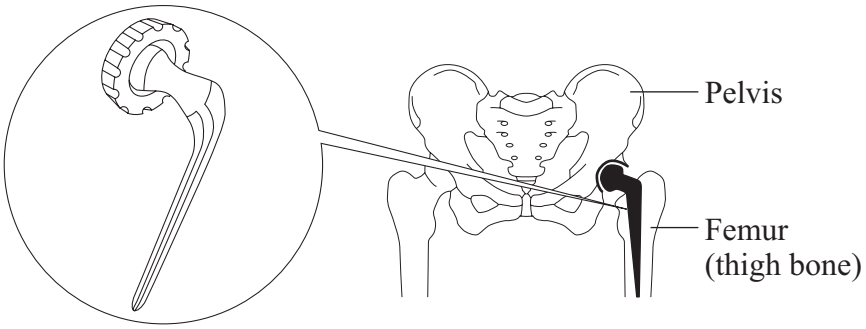
(1 mark)

6

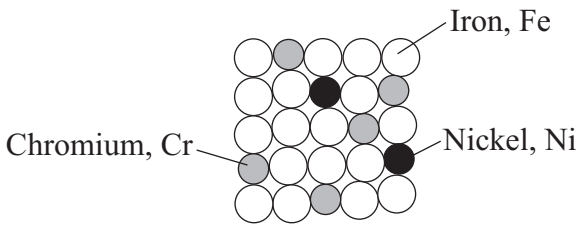
Turn over for the next question

3 The hip joint between the femur and pelvis sometimes has to be replaced.
Early hip replacement joints were made from stainless steel.



Stainless steel is an alloy of iron, chromium and nickel.

The diagram below represents the particles in stainless steel.



Particle diagram of stainless steel

3 (a) Use the particle diagram to complete the percentages of metals in this stainless steel.

The first one has been done for you.

Element	**Percentage (%)**
Iron, Fe	72
Chromium, Cr	
Nickel, Ni	

(2 marks)

3 (b) Pure iron is a relatively soft, metallic element.

3 (b) (i) Why is iron described as an *element*?

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(1 mark)

3 (b) (ii) Suggest why pure iron would **not** be suitable for a hip replacement joint.

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(1 mark)

3 (b) (iii) Use the particle diagram to help you to explain why stainless steel is harder than pure iron.

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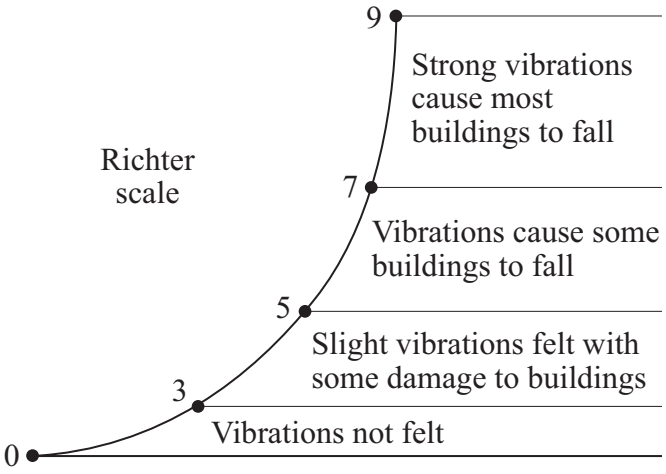
(2 marks)

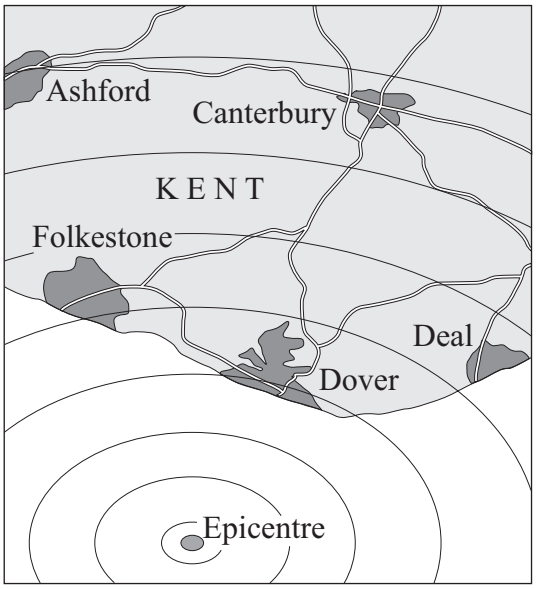
6

Turn over for the next question

4 In 1935 C.F. Richter designed a scale for comparing the size of earthquakes.



A newspaper reported that an earthquake off the coast of Kent had caused plaster to come down from ceilings, house tiles to loosen and church bells to ring.



The epicentre is the place on the surface of the Earth directly above where the earthquake occurs.

4 (a) Suggest why the earthquake in Kent was reported and why most earthquakes in the UK are **not** reported.

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(2 marks)

4 (b) Explain how earthquakes are caused.

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(3 marks)

4 (c) People living in Kent were not warned about this earthquake.

In terms of what is happening within the Earth, explain the problems of trying to predict earthquakes.

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(2 marks)

7

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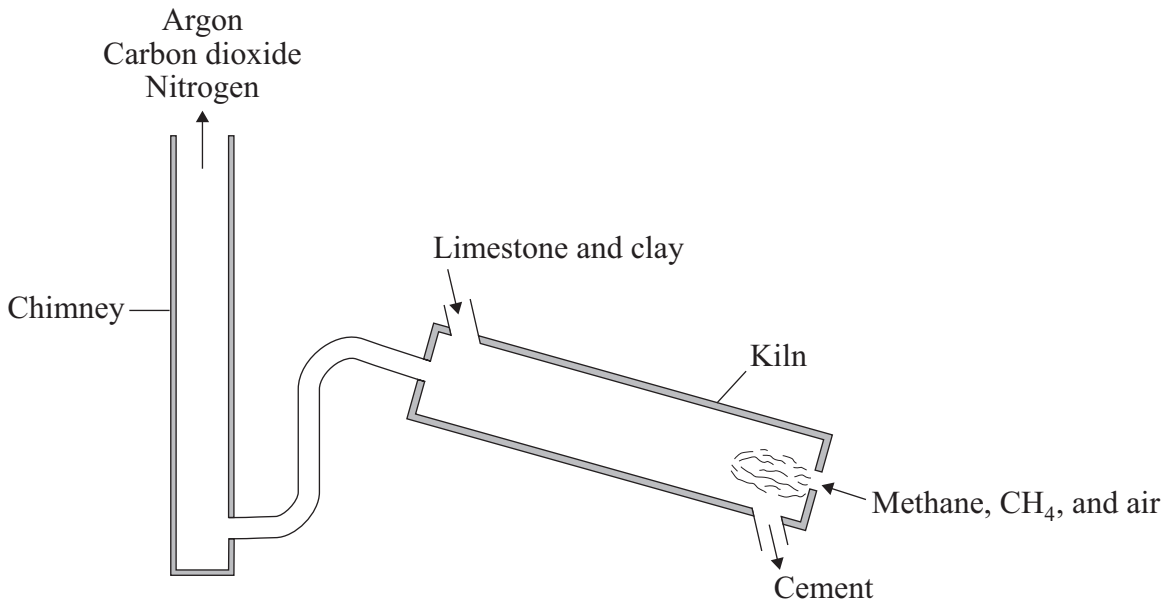
ANSWER IN THE SPACES PROVIDED

5 Limestone contains calcium carbonate, $CaCO_3$.
At a cement works, limestone is mixed with clay and heated in a kiln.



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

Explain why.

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(2 marks)

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

$CaCO_3 \rightarrow$ ..... + ...

(2 marks)

5 (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.

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(1 mark)

Turn over ▶

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

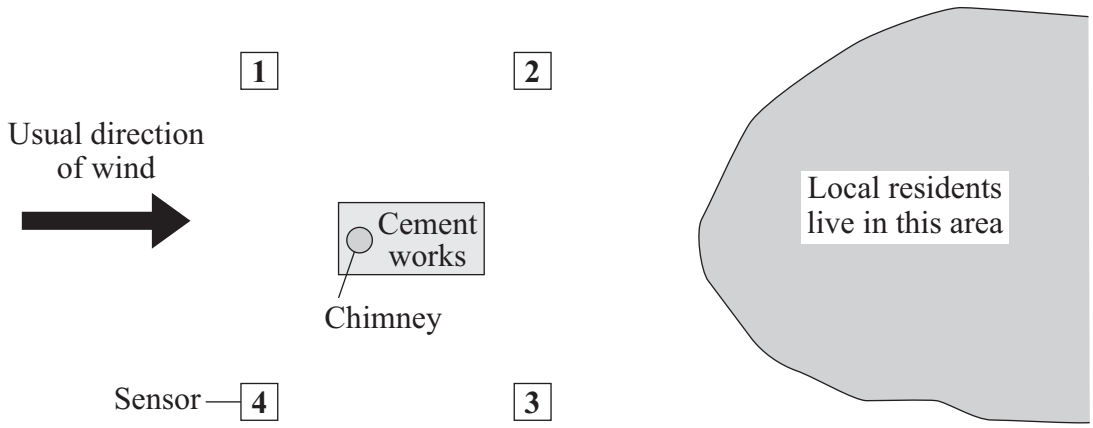
Local residents are concerned because more children are suffering asthma attacks. Residents have also noticed that parked cars are becoming dirty because of smoke particles from the chimney.

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.

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

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(2 marks)

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

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(1 mark)

5 (c) (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 marks)

11

Turn over for the next question

6 (a) Additives in some crisps include red chilli powder.

Sudan 1 is a bright red dye and is thought to cause cancer. In 2005, it was used to add more colour to a large batch of chilli powder. This batch of chilli powder was used by many food companies. The contaminated foods were removed from sale and destroyed.

6 (a) (i) Suggest why Sudan 1 does **not** have an E number.

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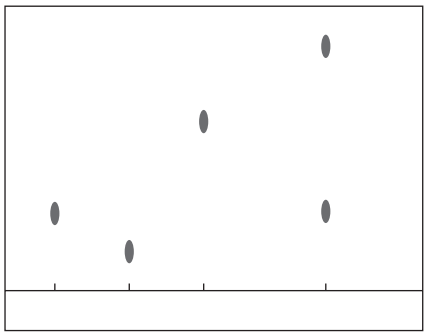
(1 mark)

6 (a) (ii) A crisp manufacturer tested its chilli powder to check that it did not contain Sudan 1.

The result of the test is shown below.



Explain how this test needs to be modified to show that the chilli powder does **not** contain Sudan 1.

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(2 marks)

6 (b) An advert for some crisps claims that they now contain only 30% saturated fat because they are cooked in sunflower oil. The crisp company used bromine water to compare percentage unsaturation of sunflower oil with four other vegetable oils, **A**, **B**, **C** and **D**.

Oil	Volume of bromine water added until the bromine colour just remains (cm^3)				Percentage unsaturation (%)
	Test 1	Test 2	Test 3	Average	
Sunflower	25.4	28.0	27.0	26.8	
A	13.0	14.0	15.0	14.0	35
B	23.2	11.2	24.0	23.6	59
C	19.9	21.1	20.2	20.4	51
D	9.5	8.8	9.3	9.2	23

6 (b) (i) What is the range of percentage unsaturation for oils **A**, **B**, **C** and **D**?

Range = ... %

(1 mark)

6 (b) (ii) Describe and explain what happens to the first drops of bromine water that are added to these oils.

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(2 marks)

6 (b) (iii) The average for oil **B** is given as 23.6 cm^3.

Explain how this average has been calculated.

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(1 mark)

Question 6 continues on the next page

Turn over ▶

6 (b) (iv) The results did **not** show that sunflower oil contains 30% saturated fat.

Explain why. (You will need to calculate the percentage unsaturation of sunflower oil.)

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(2 marks)

9

END OF QUESTIONS