

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use

General Certificate of Secondary Education
June 2008

SCIENCE B
Unit Chemistry C1

CHEMISTRY
Unit Chemistry C1

Higher Tier

Wednesday 18 June 2008 1.30 pm to 2.15 pm

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

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.

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Question	Mark	Question	Mark
1		3	
2		4	
		5	
		6	
		7	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			



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

1 Limestone is mainly calcium carbonate.

1 (a) Quicklime is produced by heating limestone.

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

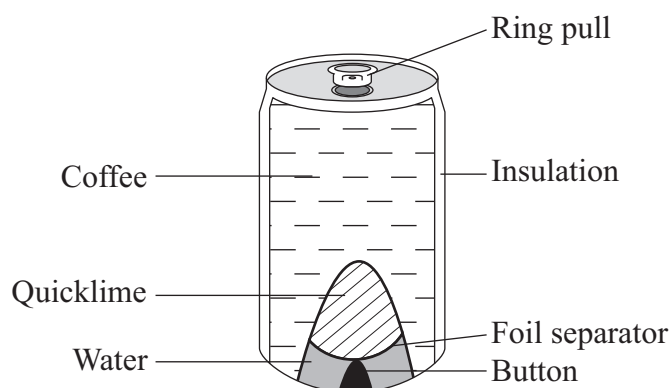
calcium carbonate → +
(2 marks)

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

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(1 mark)

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.

1 (b) (i) Explain why the coffee becomes hot.

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(2 marks)



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

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(2 marks)

7

Turn over for the next question

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2 The hydrocarbons in crude oil can be separated into useful fractions.

Fraction	Boiling point in °C	Carbon chain length	Relative % in crude oil	Relative % demand
Naphtha	20–180	5–9	10	20
Gasoline (petrol)	20–200	5–10	10	20
Kerosene (paraffin)	180–260	10–16	15	23
Diesel	260–340	14–20	20	25
Fuel oil	370–600	20–70	45	12

2 (a) Why does gasoline (petrol) have a lower boiling point than fuel oil?

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(1 mark)

2 (b) Suggest why gasoline (petrol) costs more than fuel oil.

.....

(2 marks)

2 (c) Describe how fuel oil can be changed into gasoline (petrol).

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(2 marks)

5



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3

Why blue sweets are turning white

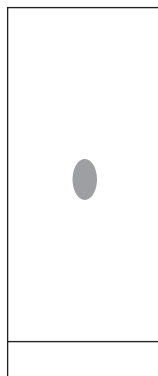
A recent study identified a possible harmful effect on children's nervous systems by some artificial colours. Two of these colours are Brilliant Blue (E133) and Quinoline Yellow (E104). Both are artificial colours because they are made from coal. The company is to stop producing the blue sweets because it is removing all artificial colours and there is no natural blue alternative.

- 3 (a) Suggest why it is important to be able to identify the colour additives in food.

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(1 mark)

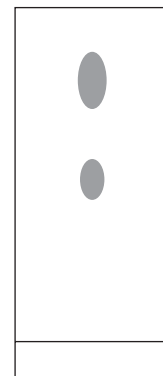
- 3 (b) A brown colour used in sweets was analysed using chromatography. The results were compared with those from E104 and E133.



E104



E133



Brown colour

What do the results tell you about the brown colour and its suitability for use in sweets?

.....

(3 marks)



- 3 (c) Once all the unsuitable colours are removed, the company claims that its sweets are now 'free from artificial colours'.

Does this mean that the sweets contain no additives? Explain your answer.

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(2 marks)

6

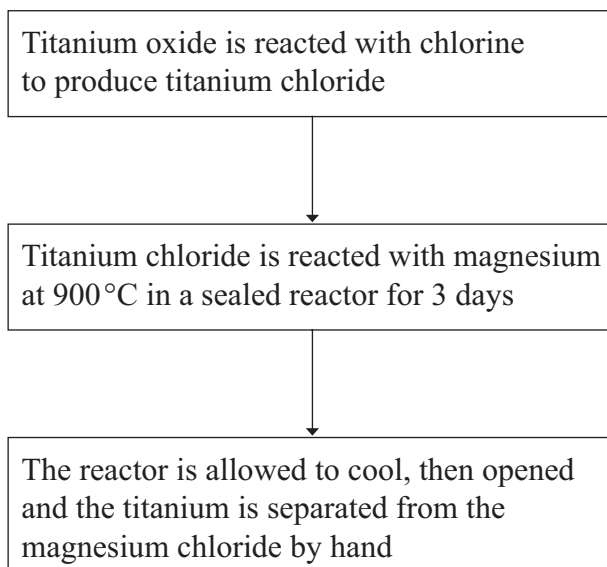
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- 4 Titanium is used in aircraft, ships and hip replacement joints. Titanium is as strong as steel but 45% lighter, and is more resistant to acids and alkalis.

Most titanium is produced from its ore, rutile (titanium oxide), by a batch process that takes up to 17 days.



Titanium reactors produce about 1 tonne of the metal per day.
Iron blast furnaces produce about 20 000 tonnes of the metal per hour.

- 4 (a) Give **one** property of titanium that makes it more useful than steel for hip replacement joints.

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(1 mark)

- 4 (b) In the reactor magnesium is used to produce titanium. If carbon were used instead of magnesium, no titanium would be produced.

What does this tell you about the relative reactivities of carbon, magnesium and titanium?

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(2 marks)



4 (c) The use of titanium is limited because it is expensive.

Explain why titanium costs more than steel.

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(3 marks)

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5

Look after your heart

A diet high in polyunsaturated fat decreases the probability of developing coronary heart disease.
A diet high in saturated fat increases the probability of developing coronary heart disease.

5 (a)

Type of oil	Polyunsaturated fat in grams per 100 g of oil	Saturated fat in grams per 100 g of oil
Maize	49	16
Olive	11	14
Palm	8	45
Soya Bean	57	14

Use the information from the table above to answer each question.

5 (a) (i) Which type of oil appears to be best for your heart? Explain your answer.

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(2 marks)

5 (a) (ii) Cultures that use only olive oil in food preparation have less heart disease than cultures that use other types of oil.

Suggest a possible reason for this.

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(1 mark)



- 5 (b) A company compared the relative 'unsaturation' of five oils. Bromine water was added from a burette to equal amounts of each oil until the bromine water remained orange-yellow.

The volume added was recorded.

Type of oil	Volume of bromine water added in cm ³
Maize	25.6
Olive	6.1
Palm	4.9
Soya Bean	29.9
Sunflower	25.1

- 5 (b) (i) What would you see when the first few drops of bromine water are added to each oil?

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(1 mark)

- 5 (b) (ii) What do these results tell you about sunflower oil compared with the other oils?

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(2 marks)

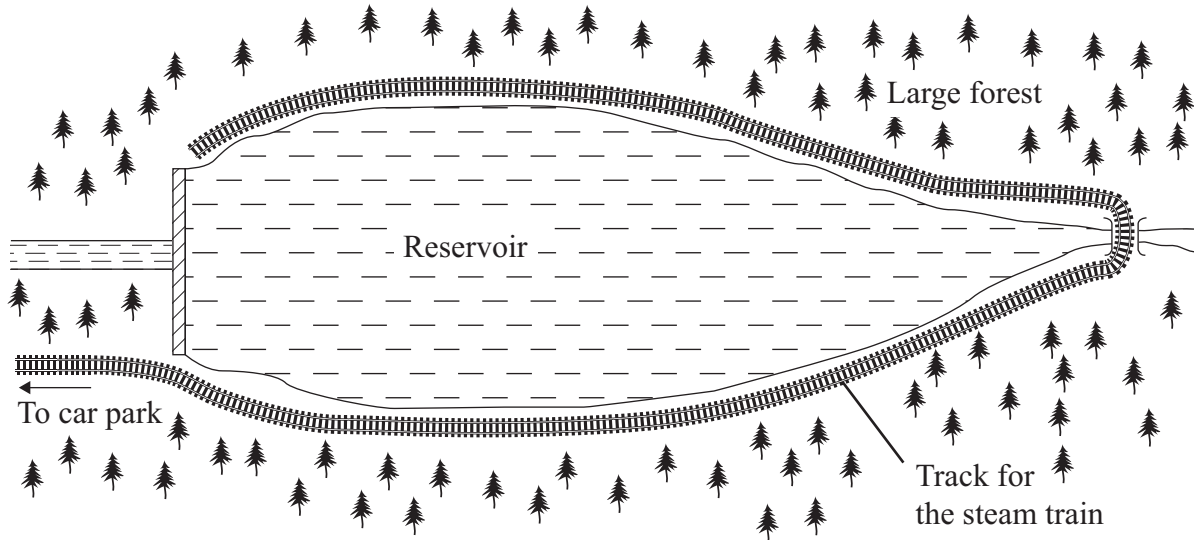
6

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- 6 A large reservoir is surrounded by trees. Planners need to protect the environment. The distance around the reservoir is many kilometres. There will be only one road access to a car park a few kilometres from the reservoir. From the car park people would be transported to accommodation, activities or places of interest by steam train.



- 6 (a) Coal contains carbon and small amounts of sulfur. The steam train would cause environmental problems if coal were used as the fuel.

Explain why.

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(4 marks)



- 6 (b) The planners have stated that, as a result of using the steam train, there must be no overall increase of carbon dioxide added to the atmosphere. The steam train would be considered as ‘carbon neutral’ if wood, from the surrounding forest, were used as the fuel.

Suggest why.

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(3 marks)

7

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7 Scientists study the atmosphere on planets and moons in the Solar System to understand how the Earth’s atmosphere has changed.

7 (a) Millions of years ago the Earth’s atmosphere was probably just like that of Mars today.

The table shows data about the atmospheres of Mars and Earth as they are now.

Mars		Earth	
nitrogen	3 %	nitrogen	78 %
oxygen	trace	oxygen	21 %
water	trace	water	trace
carbon dioxide	95 %	carbon dioxide	trace
Average surface temperature $-23\text{ }^{\circ}\text{C}$		Average surface temperature $15\text{ }^{\circ}\text{C}$	

Suggest what has caused the main gases in the Earth’s atmosphere of millions of years ago to change to the present-day atmosphere.

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(2 marks)

7 (b) Titan is the largest moon of the planet Saturn. It has an atmosphere that, like the Earth’s, contains mainly nitrogen. Methane is the other main gas.

Main gases in Titan’s atmosphere	Percentage (%)	Boiling point in $^{\circ}\text{C}$
Nitrogen	95	-196
Methane	5	-164
Average surface temperature $-178\text{ }^{\circ}\text{C}$		

When it rains on Titan, it rains methane! Explain why.

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(2 marks)



7 (c) Ultraviolet radiation from the Sun produces simple alkenes, such as ethene and propene, from methane in Titan's atmosphere.

7 (c) (i) Draw the structure of propene, C_3H_6 , to show the covalent bonds.

(1 mark)

7 (c) (ii) Explain how propene molecules form a polymer. You should name the polymer formed.

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(3 marks)

8

END OF QUESTIONS



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