

Centre Number						Candidate Number				
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For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	



General Certificate of Secondary Education
Higher Tier
June 2014

Science A
Unit Chemistry C1

CH1HP

H

Chemistry
Unit Chemistry C1

Tuesday 10 June 2014 1.30 pm to 2.30 pm

For this paper you must have:

- a ruler
 - the Chemistry Data Sheet (enclosed).
- You may use a calculator.

Time allowed

- 1 hour

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.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 2(b) should be answered in continuous prose.
In this question you will be marked on your ability to:
 - use good English
 - organise information clearly
 - use specialist vocabulary where appropriate.

Advice

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



J U N 1 4 C H 1 H P O 1

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CH1HP

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

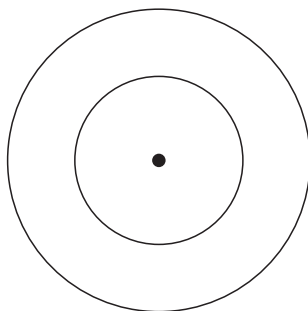
1 Fossil fuels contain carbon and hydrogen.

1 (a) (i) Use the Chemistry Data Sheet to help you to answer this question.

Complete **Figure 1** to show the electronic structure of a carbon atom.

[1 mark]

Figure 1



1 (a) (ii) Complete the word equation for the oxidation of hydrogen.

[1 mark]

hydrogen + oxygen \longrightarrow

1 (b) Coal is a fossil fuel.

Coal contains the elements hydrogen, sulfur, oxygen and carbon.

Name **two** products of burning coal that have an impact on the environment.

What impact does each of the products you named have on the environment?

[4 marks]

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2 Ethanol and vegetable oil are used as fuels.

2 (a) There are two different ways to produce ethanol:

- using ethene from crude oil
- using sugar from plants.

2 (a) (i) Ethanol is produced from ethene by **hydration** in the presence of a catalyst.

What is **hydration**?

[1 mark]

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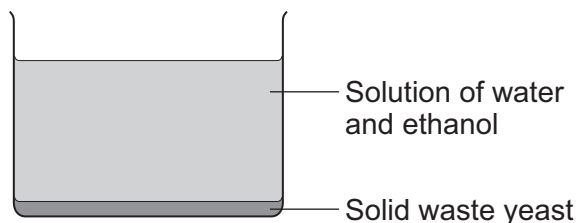
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2 (a) (ii) Fermentation is used to produce ethanol from sugar by:

- dissolving the sugar in water
- adding yeast to the sugar solution
- leaving the mixture for three days.

Figure 2 shows the substances after three days.

Figure 2



Suggest:

- how the solid waste yeast is removed
- how ethanol is obtained from the solution.

[2 marks]

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Turn over ►



2 (b) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Crude oil is separated to produce the fraction petroleum diesel.

Worries about low supplies of crude oil have led to the growing of large areas of crops to produce vegetable oil.

Vegetable oils are used to produce biodiesel.

There are economic, ethical and environmental issues about the use of biodiesel.

Biodiesel and petroleum diesel are used as a fuel for cars. In a car engine the fuel burns and releases waste products through the car exhaust system.

Table 1 shows the amount of waste products formed by biodiesel compared with the amount of waste products formed by petroleum diesel.

(Note that ppm is parts per million.)

Table 1

	Carbon dioxide in ppm	Nitrogen oxides in ppm	Sulfur dioxide in ppm	Particulates in g per m³
Biodiesel	20 000	760	0	0.3
Petroleum diesel	80 000	700	300	0.6

Use this information and your knowledge and understanding to give advantages and disadvantages of using biodiesel instead of petroleum diesel.

[6 marks]

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Turn over ►



- 3** Cooking oils contain unsaturated fats. Unsaturated fats are more healthy than saturated fats.

Unsaturated fats change bromine water from orange to colourless.

A scientist from a food company called Vegio wanted to find the amount of unsaturated fat in cooking oils.

The scientist tested Vegio's own brand of oil and oils from four other companies, **A**, **B**, **C** and **D**.

The scientist used the same volume of oil for each test.

The scientist's results are shown in **Table 2**.

Table 2

Company	Number of drops of bromine water that reacted		
	Test 1	Test 2	Test 3
Vegio	14	13	16
A	25	17	27
B	17	18	16
C	5	6	4
D	10	9	7

- 3 (a) (i)** Describe how the bromine water is used to obtain these results.

[3 marks]

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3 (a) (ii) Choose **one** result from **Table 2** that should be tested again.

Result: Company Test

Why did you choose this result?

[2 marks]

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3 (a) (iii) The same volume of each oil was used for each test.

Suggest **one** other variable that should be controlled in these tests.

[1 mark]

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3 (b) The Vegio food company claims that its cooking oil has more unsaturated fat than other cooking oils.

Compare the results for Vegio’s cooking oil with the results of the other companies, **A, B, C** and **D**.

Give **three** conclusions that can be made from the results.

[3 marks]

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- 4 Where copper ore has been mined there are areas of land that contain very low percentages of copper compounds.

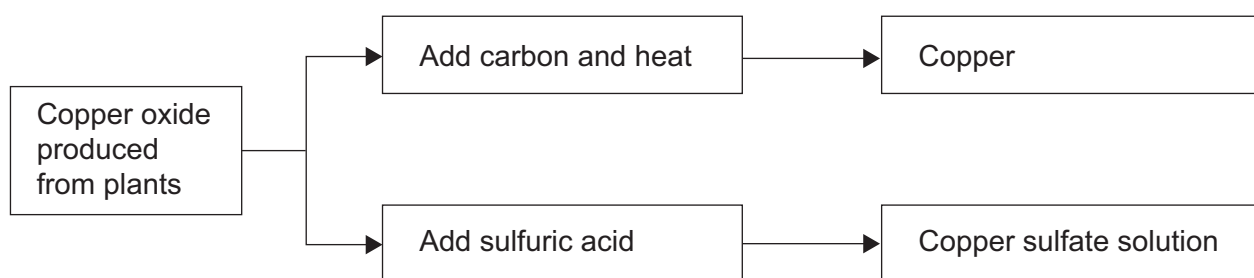
One way to extract the copper is to grow plants on the land.

The plants absorb copper compounds through their roots.

The plants are burned to produce copper oxide.

The copper oxide produced from plants can be reacted to produce copper or copper sulfate solution, as shown in **Figure 3**.

Figure 3



- 4 (a) (i) Complete the sentence.

[1 mark]

Using plants to extract metals is called

- 4 (a) (ii) Suggest **two** reasons why copper from these areas of land is **not** extracted by smelting.

[2 marks]

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- 4 (a) (iii) Complete and balance the chemical equation for the reaction of copper oxide with carbon.

[2 marks]



4 (b) Copper is produced from copper sulfate solution by displacement using scrap iron or by electrolysis.

4 (b) (i) Use the Chemistry Data Sheet to help you to answer this question.

Give **two** reasons why scrap iron is used to displace copper.

[2 marks]

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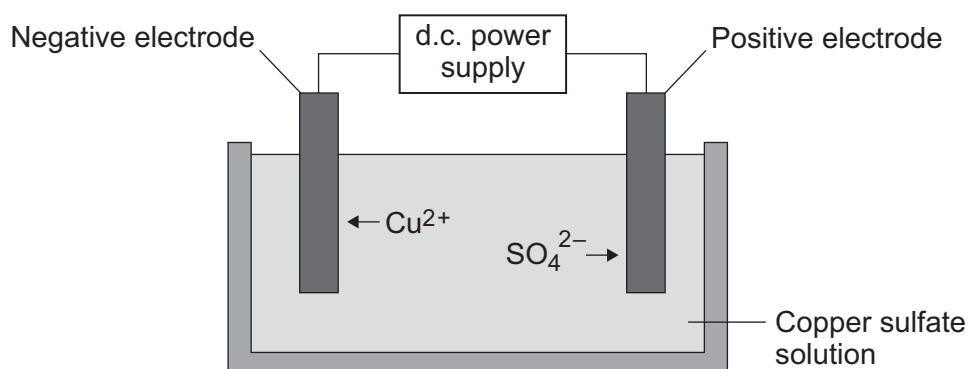
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4 (b) (ii) Figure 4 shows the electrolysis of copper sulfate solution.

Figure 4



Describe what happens to the copper ions during electrolysis.

[2 marks]

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5 Limestone contains calcium carbonate (CaCO_3).

5 (a) Name the type of reaction that takes place when calcium carbonate is heated strongly.

Name the products formed.

[3 marks]

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5 (b) A student investigated what happens when limestone is heated strongly.

This is the method the student used:

- measure the mass of limestone before heating
- measure the mass of solid product after heating
- repeat the experiment three more times.

The student's results are shown in **Table 3**.

Table 3

	Experiment 1	Experiment 2	Experiment 3	Experiment 4
Mass of limestone before heating in g	5.0	5.0	5.0	5.0
Mass of solid product after heating in g	3.2	4.0	3.1	3.3
Mass lost in g	1.8	1.0	1.9	1.7

5 (b) (i) Calculate the mean mass lost, taking account of any anomalies.

[2 marks]

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Mean mass lost = g



5 (b) (ii) The student used the chemical equation to calculate the maximum mass lost by 5.0 g of calcium carbonate when heated.

The maximum mass lost is 2.2 g.

Suggest and explain **two** reasons why the mean mass lost in the experiments to heat limestone is less than 2.2 g.

Do **not** include any reference to weighing errors in your answer.

[4 marks]

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Turn over for the next question

Turn over ►



6 (b) Table 4 shows some properties of gases in the Earth's atmosphere.

Table 4

Gas	Melting point in °C	Boiling point in °C
Argon	-189	-186
Carbon dioxide	-78	-78
Helium	-272	-269
Neon	-249	-246
Nitrogen	-210	-196
Oxygen	-219	-183

These gases are separated by:

- removing carbon dioxide
- cooling the remaining gases to $-200\text{ }^{\circ}\text{C}$
- removing the gases that do not condense
- allowing the liquefied gases to warm up.

6 (b) (i) Suggest **one** reason why carbon dioxide is removed before the gases are cooled to $-200\text{ }^{\circ}\text{C}$.

[1 mark]

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6 (b) (ii) Draw a ring around **one** gas that does **not** condense when the remaining gases are cooled to $-200\text{ }^{\circ}\text{C}$.

[1 mark]

argon

neon

nitrogen

oxygen

6 (b) (iii) The oxygen separated by this process contains another gas.

Name the gas and give a reason for your answer.

[2 marks]

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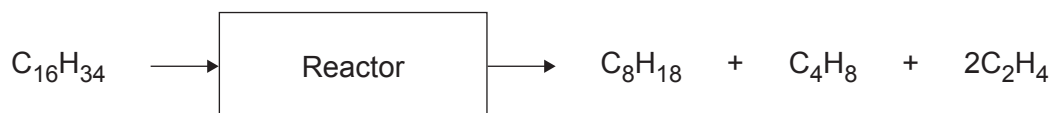
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7 Poly(butene) is a polymer made from crude oil in two stages.

7 (a) The first stage in making poly(butene) is to break down large hydrocarbon molecules from crude oil into smaller hydrocarbon molecules, as shown in **Figure 6**.

Figure 6



7 (a) (i) The products contain two types of hydrocarbon with different general formulae.

Name the two types of hydrocarbon.

[1 mark]

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7 (a) (ii) Describe the conditions in the reactor.

[2 marks]

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7 (a) (iii) Suggest why air must **not** enter the reactor.

[1 mark]

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7 (a) (iv) Suggest a method that can be used to separate butene (C_4H_8) from the other hydrocarbons.

[1 mark]

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7 (b) The second stage is to use butene (C_4H_8) to produce poly(butene).

7 (b) (i) Draw the displayed structure of a butene (C_4H_8) molecule.

[1 mark]

7 (b) (ii) Describe how molecules of butene (C_4H_8) form poly(butene).

[2 marks]

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8

END OF QUESTIONS



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ANSWER IN THE SPACES PROVIDED**

