

Please write clearly in block capitals.

Centre number

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Candidate number

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# GCSE SCIENCE A CHEMISTRY

# H

Higher Tier Unit Chemistry C1

Thursday 19 May 2016

Morning

Time allowed: 1 hour

## Materials

For this paper you must have:

- a ruler
- the Chemistry Data Sheet (enclosed).

You may use a calculator.

## 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(c) 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.

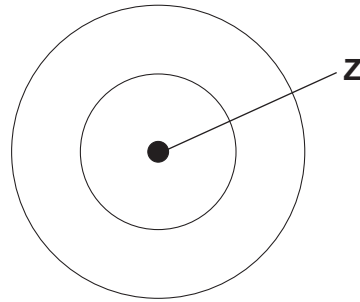


Answer **all** questions in the spaces provided.

**1** There are eight elements in the second row (lithium to neon) of the periodic table.

**1 (a)** **Figure 1** shows an atom with two energy levels (shells).

**Figure 1**



**1 (a) (i)** Complete **Figure 1** to show the electronic structure of a boron atom.

[1 mark]

**1 (a) (ii)** What does the central part labelled **Z** represent in **Figure 1**?

[1 mark]

\_\_\_\_\_

**1 (a) (iii)** Name the sub-atomic particles in part **Z** of a boron atom.

Give the relative charges of these sub-atomic particles.

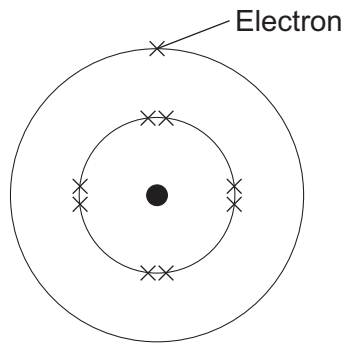
[3 marks]

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



- 1 (b) The electronic structure of a neon atom shown in **Figure 2** is **not** correct.

**Figure 2**



Explain what is wrong with the electronic structure shown in **Figure 2**.

**[3 marks]**

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ANSWER IN THE SPACES PROVIDED**

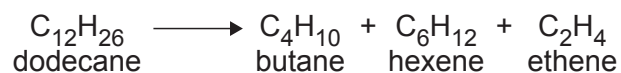


2 This question is about hydrocarbons.

2 (a) Most of the hydrocarbons in crude oil are alkanes.

2 (a) (i) Large alkane molecules can be cracked to produce more useful molecules.

The equation shows the cracking of dodecane.



Give **two** conditions used to crack large alkane molecules.

[2 marks]

1 \_\_\_\_\_

2 \_\_\_\_\_

2 (a) (ii) The products hexene and ethene are alkenes.

Complete the sentence.

[1 mark]

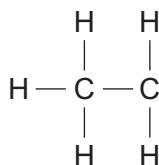
When alkenes react with bromine water the colour changes

from orange to \_\_\_\_\_ .

2 (a) (iii) Butane (C<sub>4</sub>H<sub>10</sub>) is an alkane.

Complete the displayed structure of butane.

[1 mark]



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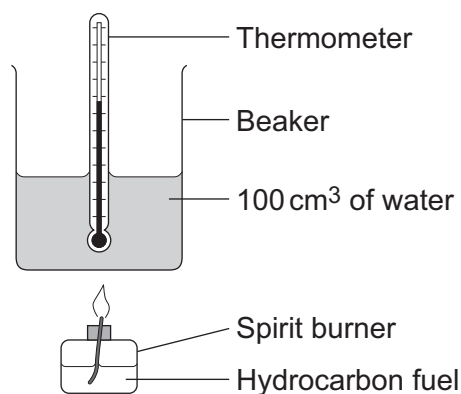
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- 2 (b) A group of students investigated the energy released by the combustion of four hydrocarbon fuels.

Figure 3 shows the apparatus used.

Figure 3



Each hydrocarbon fuel was burned for two minutes.

Table 1 shows the students' results.

Table 1

Name and formula of hydrocarbon fuel	After two minutes				
	Mass of fuel used in g	Temperature increase of water in °C	Energy released by fuel in kJ	Energy released by 1.0 g of fuel in kJ	Relative amount of smoke in the flame
Hexane, $C_6H_{14}$	0.81	40	16.80	20.74	very little smoke
Octane, $C_8H_{18}$	1.10	54	22.68	20.62	some smoke
Decane, $C_{10}H_{22}$	1.20	58	24.36		smoky
Dodecane, $C_{12}H_{26}$	1.41	67	28.14	19.96	very smoky



2 (b) (i) Calculate the energy released by 1.0 g of decane in kJ.

[2 marks]

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Energy released = \_\_\_\_\_ kJ

2 (b) (ii) Suggest **one** improvement to the apparatus, or the use of the apparatus, that would make the temperature increase of the water for each fuel more accurate.

Give a reason why this is an improvement.

[2 marks]

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2 (b) (iii) The students noticed that the bottom of the beaker became covered in a black substance when burning these fuels.

Name this black substance.

Suggest why it is produced.

[2 marks]

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2 (b) (iv) A student concluded that hexane is the best of the four fuels.

Give **two** reasons why the results in **Table 1** support this conclusion.

[2 marks]

1 \_\_\_\_\_

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2 \_\_\_\_\_

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Question 2 continues on the next page

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

Most car engines use petrol as a fuel.

- Petrol is produced from the fractional distillation of crude oil.
- Crude oil is a mixture of hydrocarbons.
- Sulfur is an impurity in crude oil.

Car engines could be developed to burn hydrogen as a fuel.

- Hydrogen is produced from natural gas.
- Natural gas is mainly methane.

**Table 2** shows information about petrol and hydrogen.

**Table 2**

	<b>Petrol</b>	<b>Hydrogen</b>
State of fuel at room temperature	Liquid	Gas
Word equation for combustion of the fuel	petrol + oxygen $\longrightarrow$ carbon dioxide + water	hydrogen + oxygen $\longrightarrow$ water
Energy released from combustion of 1 g of the fuel	47 kJ	142 kJ

Describe the **advantages** and **disadvantages** of using hydrogen instead of petrol in car engines.

Use the information given and your knowledge and understanding to answer this question.

**[6 marks]**

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**3** Metals are extracted from ores in the Earth's crust.

Some ores contain metal carbonates and some ores contain metal oxides.

**3 (a) (i)** Name the type of reaction that happens when a metal carbonate is heated.

[1 mark]

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**3 (a) (ii)** Which solid product is formed when copper carbonate is heated?

[1 mark]

Tick (✓) **one** box.

copper

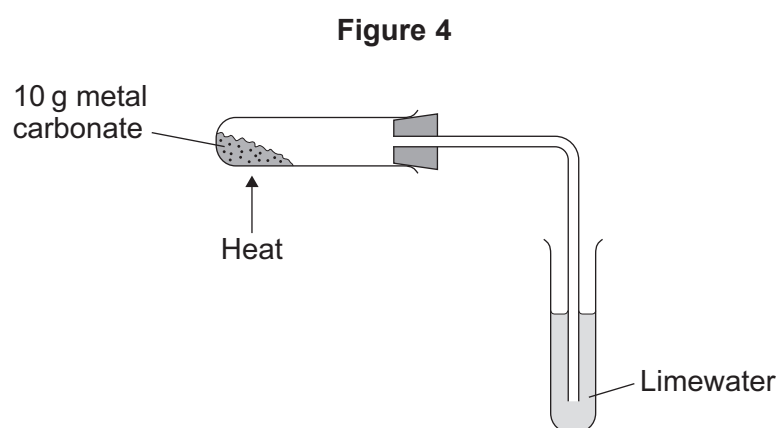
copper nitrate

copper oxide

copper sulfide

**3 (b)** A student investigated heating four metal carbonates.

**Figure 4** shows the apparatus used.



The student heated each metal carbonate for five minutes.

**Table 3** shows the results.

**Table 3**

<b>Metal carbonate</b>	<b>Mass of metal carbonate at start in g</b>	<b>Mass of solid after heating for 5 minutes in g</b>	<b>Observations</b>
Copper carbonate	10.0	6.9	Limewater turns cloudy
Magnesium carbonate	10.0	9.1	Limewater turns cloudy
Potassium carbonate	10.0	10.0	Limewater does not turn cloudy
Zinc carbonate	10.0	8.3	Limewater turns cloudy

**3 (b) (i)** Explain the results for potassium carbonate.

**[3 marks]**

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**3 (b) (ii)** Suggest how the reactivity series can be used to predict which metal carbonate reacts most easily when heated.

**[2 marks]**

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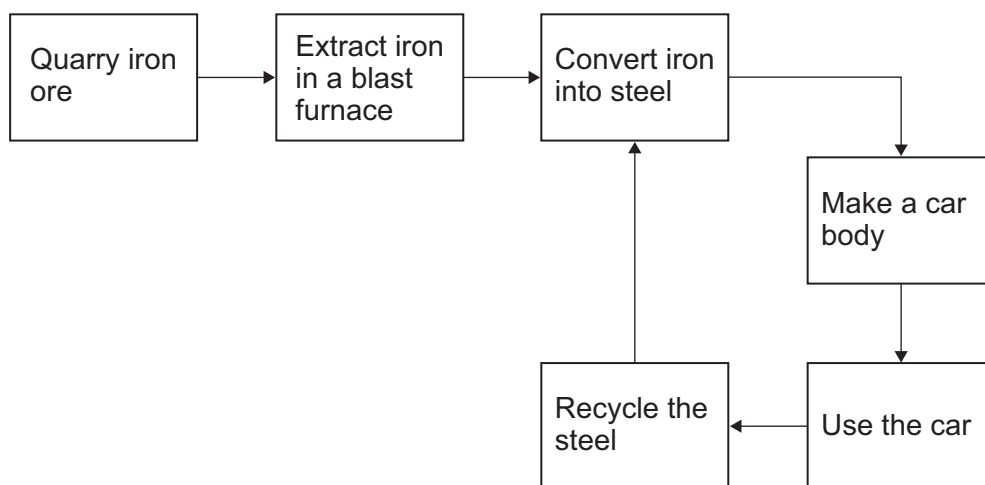
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3 (c) Figure 5 shows a simple life cycle of a car body.

Figure 5



3 (c) (i) Complete the sentence.

[1 mark]

Iron ores must contain enough iron to \_\_\_\_\_

\_\_\_\_\_

3 (c) (ii) Some iron ores contain iron oxide ( $\text{Fe}_2\text{O}_3$ ).

Complete and balance the equation for a reaction to produce iron from iron oxide.

[2 marks]



3 (c) (iii) Give **two** reasons why iron produced in a blast furnace is converted into steel.

[2 marks]

\_\_\_\_\_

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\_\_\_\_\_

\_\_\_\_\_



**3 (c) (iv)** When a car reaches the end of its useful life, the car body can be:

- recycled
- reused
- sent to landfill.

Give **three** reasons why a steel car body should be recycled and **not** reused or sent to landfill.

**[3 marks]**

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<b>15</b>

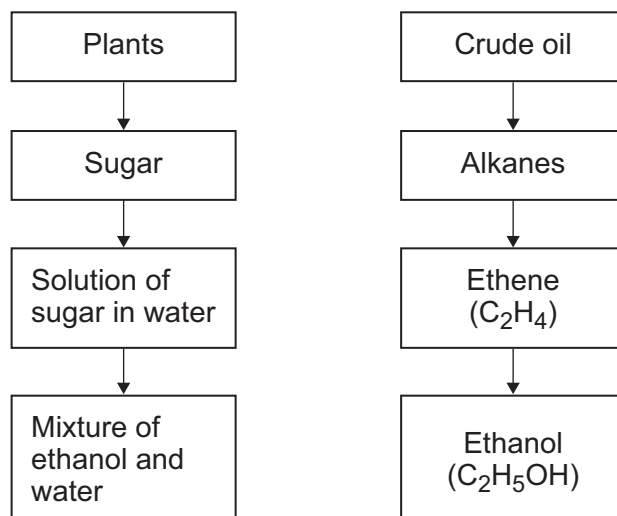
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4 Ethanol can be made from plants and from crude oil as shown in **Figure 6**.

**Figure 6**



4 (a) (i) Describe how the solution of sugar in water is used to produce the mixture of ethanol and water.

**[2 marks]**

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4 (a) (ii) Describe how ethanol is produced from ethene.

**[2 marks]**

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**4 (b)** Explain **one** advantage and **one** disadvantage of using crude oil to make ethanol instead of using plants.

**[4 marks]**

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**4 (c)** Ethanol has a boiling point of 78 °C.  
Water has a boiling point of 100 °C.

Describe how distillation is used to separate a mixture of ethanol and water.

**[3 marks]**

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