

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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



General Certificate of Secondary Education  
Higher Tier  
January 2012

**Science A**  
Unit Chemistry C1

**CH1HP**

**H**

**Chemistry**  
Unit Chemistry C1

**Wednesday 18 January 2012 9.00 am to 10.00 am**

**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 7(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 A N 1 2 C H 1 H P O 1

J80862 6/6/6

**CH1HP**

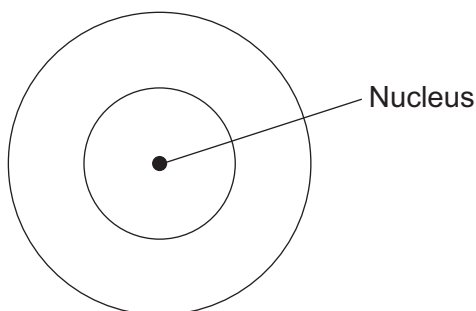
Answer **all** questions in the spaces provided.

- 1** The picture shows a diamond ring.



- 1 (a)** Diamond is a form of carbon. A carbon atom has six electrons.

Draw the electronic structure of a carbon atom.



(1 mark)

- 1 (b)** A gold atom has an atomic number of 79 and a mass number of 197.

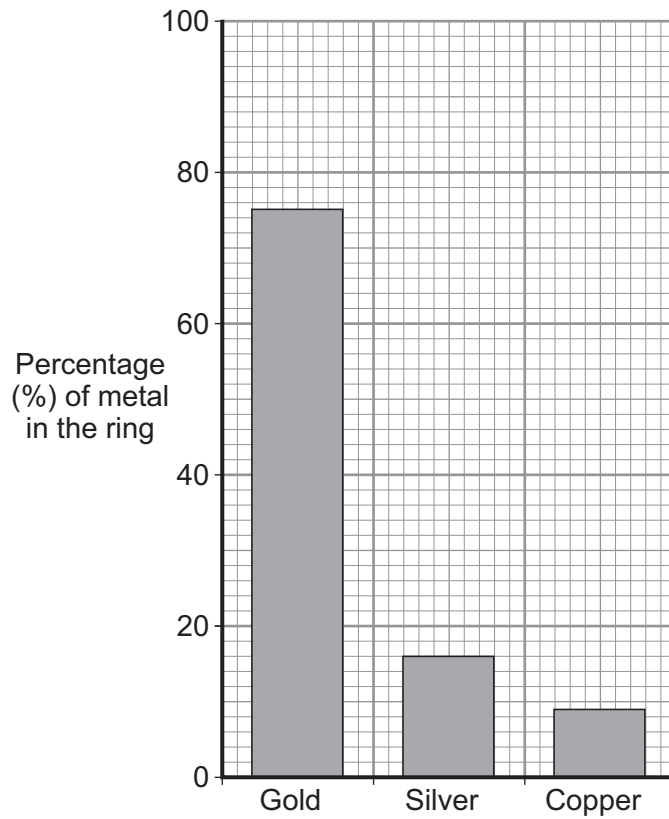
Complete the table to show the name and number of each sub-atomic particle in this gold atom.

Name	Number
Proton	79
Electron	.....
.....	.....

(3 marks)



1 (c) The bar chart shows the composition of this gold ring.



1 (c) (i) Give the percentage of the other two metals in this gold ring.

Silver is .....% and copper is .....%

(1 mark)

1 (c) (ii) This gold ring is not made from 100% gold.

Give **two** reasons why.

1 .....

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.....

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2 .....

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(2 marks)

7

Turn over ►



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- 2 A mixture of petrol and air is burned in a car engine.  
Petrol is a mixture of alkanes. Air is a mixture of gases.

The tables give information about the composition of petrol and the composition of air.

Petrol	
Alkane	Formula
hexane	$C_6H_{14}$
heptane	
octane	$C_8H_{18}$
nonane	$C_9H_{20}$
decane	$C_{10}H_{22}$

Air	
Gas	Percentage (%)
nitrogen	78
oxygen	21
carbon dioxide	0.035
Small amounts of other gases and water vapour	

- 2 (a) Use the information above to answer these questions.

- 2 (a) (i) Give the formula for heptane.

.....  
(1 mark)

- 2 (a) (ii) Complete the general formula of alkanes.  
n = number of carbon atoms



(1 mark)

- 2 (b) Alkanes in petrol burn in air.  
The equations represent two reactions of hexane burning in air.



**Reaction 2** produces a different carbon compound to **Reaction 1**.

- 2 (b) (i) Name the carbon compound produced in **Reaction 2**.

.....  
(1 mark)

- 2 (b) (ii) Give a reason why the carbon compounds produced are different.

.....  
.....  
(1 mark)

Question 2 continues on the next page

Turn over ►



**2 (c)** The table shows the percentages of some gases in the exhaust from a petrol engine.

Name of gas	Percentage (%)
nitrogen	68
carbon dioxide	15
carbon monoxide	1.0
oxygen	0.75
nitrogen oxides	0.24
hydrocarbons	0.005
sulfur dioxide	0.005
other gases	

**2 (c) (i)** What is the percentage of the other gases in the table?

.....  
(1 mark)

**2 (c) (ii)** What is the name of the compound that makes up most of the other gases?

.....  
(1 mark)

**2 (c) (iii)** Give a reason why sulfur dioxide is produced in a petrol engine.

.....  
.....  
(1 mark)

**2 (c) (iv)** State how nitrogen oxides are produced in a petrol engine.

.....  
.....  
.....  
.....  
(2 marks)



**2 (d)** Many scientists are concerned about the carbon dioxide released from burning fossil fuels such as petrol.

Explain why.

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(2 marks)

11

**Turn over for the next question**

**Turn over ►**



- 3** There are about 500 000 earthquakes every year. On 12 January 2010 there was an earthquake near Port-au-Prince in Haiti. Many buildings were destroyed causing the deaths of thousands of people. The earthquake did not come as a surprise to scientists who predicted the earthquake a week earlier. The Government and people ignored the prediction.



The Richter scale is used to compare the size of earthquakes.

Richter scale value	Effect of earthquake
Less than 2	People do not feel the earthquake.
2–4	People feel the earthquake but the earthquake rarely causes damage to buildings.
4–5	People feel the earthquake and the earthquake causes minor damage to a few buildings.
5–6	Shaking of the ground and major damage to some buildings.
6–8	Violent shaking of the ground and many buildings destroyed.
8–10	Very violent shaking of the ground and most buildings destroyed.

- 3 (a)** Use the information above to answer these questions.

- 3 (a) (i)** Suggest the Richter scale value for the earthquake that happened near Port-au-Prince in Haiti.

.....  
(1 mark)

- 3 (a) (ii)** Governments and people often ignore scientists' predictions of an earthquake.

Suggest **three** reasons why.

1 .....

.....

.....





2 .....

.....

.....

3 .....

.....

.....

(3 marks)

**3 (b)** During the twentieth century many scientists proposed ideas about the cause of earthquakes and about the Earth's crust.  
 In 1912 Alfred Wegener proposed his idea of '*continental drift*'.  
 In 1930 Arthur Holmes suggested his idea of '*mantle dynamics*'.

**3 (b) (i)** What did Wegener mean by '*continental drift*'?

.....

.....

.....

.....

(2 marks)

**3 (b) (ii)** Holmes' idea of '*mantle dynamics*' provided an explanation for Wegener's idea of '*continental drift*'.

Suggest what '*mantle dynamics*' is and state what causes '*mantle dynamics*'.

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(2 marks)

8

Turn over ►



- 4 Cans for food and drinks are made from steel or aluminium.  
The main metal in steel is iron.

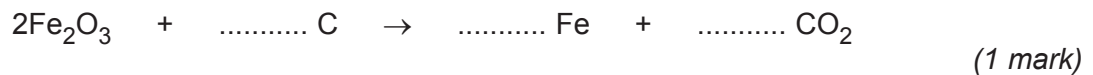


- 4 (a) Iron is extracted by heating a mixture of iron oxide and carbon in a blast furnace.

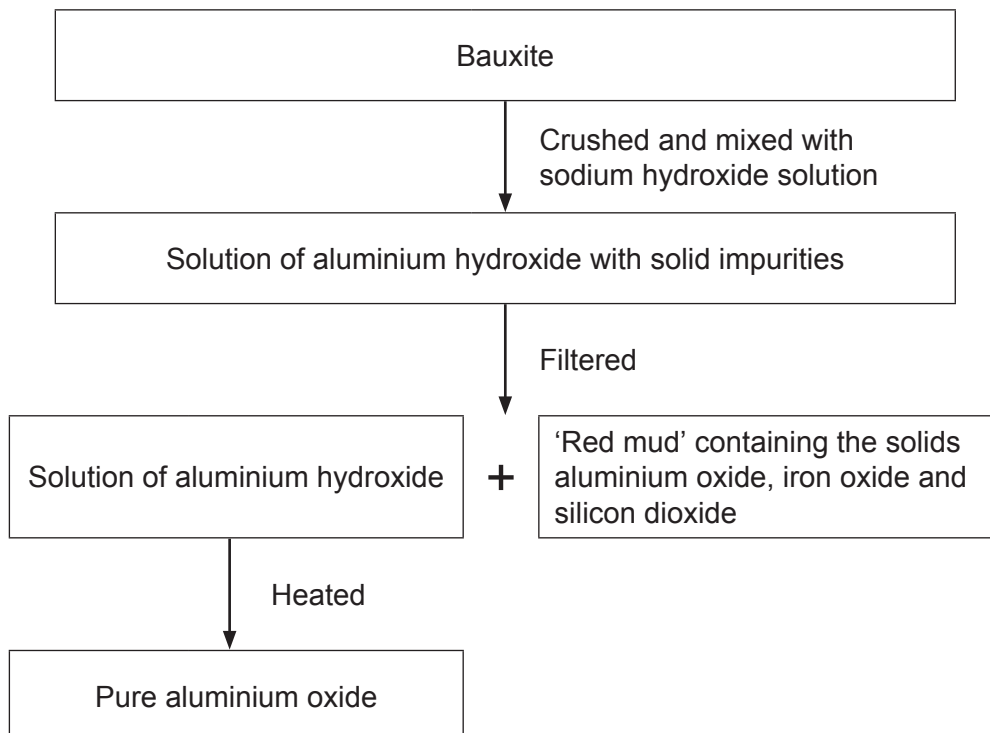
- 4 (a) (i) Name this type of reaction.

.....  
(1 mark)

- 4 (a) (ii) Balance the symbol equation for this reaction.



- 4 (b) Aluminium ore, bauxite, contains aluminium oxide, iron oxide and silicon dioxide.  
Aluminium is extracted by electrolysis of aluminium oxide.



The 'red mud' which is dumped in very large ponds contains:

Name of solid	Percentage (%)
Aluminium oxide	10
Iron oxide	65
Silicon dioxide	25

- 4 (b) (i) 100 tonnes of bauxite produced 50 tonnes of pure aluminium oxide and 50 tonnes of 'red mud'.

What percentage of aluminium oxide did the bauxite contain?

.....

Answer = ..... %  
(1 mark)

- 4 (b) (ii) Apart from the solids shown in the table, name **one** other substance that would be in the 'red mud'.

.....  
(1 mark)

- 4 (b) (iii) The purification of the aluminium oxide is usually done near to the bauxite quarries.

Suggest **one** reason why.

.....  
(1 mark)

- 4 (c) Aluminium is used to make many things including cans.

During one year in the USA:

- 100 billion aluminium cans were sold
- 55 billion aluminium cans were recycled.

Give **one** environmental impact of recycling aluminium cans and **one** ethical or social impact of recycling aluminium cans.

Environmental .....

.....

Ethical or social .....

.....

(2 marks)

7
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Turn over ►

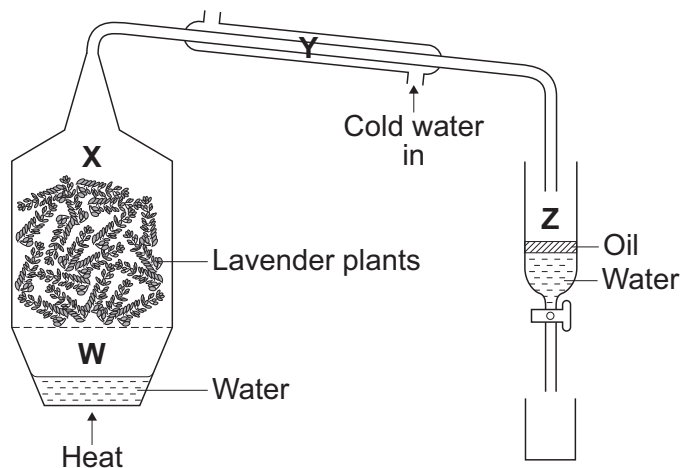


5 This question is about plant oils.

5 (a) Steam distillation is used to separate oils from plants.

The diagram shows some apparatus that can be used to separate oil from lavender plants.

Four parts of the apparatus are labelled **W**, **X**, **Y** and **Z**.



Describe how lavender oil is separated from the plant material.

You need to describe what happens in each of the parts, **W**, **X**, **Y** and **Z**, of the apparatus.

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(4 marks)



**5 (b)** Olive oil can be used in the manufacture of margarine.  
Olive oil has a melting point of  $-6\text{ }^{\circ}\text{C}$  and contains about 11% saturated fat and 89% unsaturated fat.

**5 (b) (i)** Describe a test to show that olive oil contains unsaturated compounds.

Give the result of the test.

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(2 marks)

**5 (b) (ii)** To make margarine from olive oil the percentage of unsaturated fat needs to be decreased.

Give **one** reason why.

.....  
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(1 mark)

**5 (b) (iii)** Describe how to decrease the percentage of unsaturated fat in olive oil.

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(3 marks)

<b>10</b>

Turn over ►



**6** Limestone is used as a building material. Acid rain erodes limestone.

**6 (a)** Limestone contains calcium carbonate.  
The symbol equation for the reaction of calcium carbonate with hydrochloric acid is shown.



Describe a test to show that carbon dioxide is produced in this reaction.

Give the result of the test.

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(2 marks)

**6 (b)** Gases from vehicle exhausts produce sulfuric acid and nitric acid.

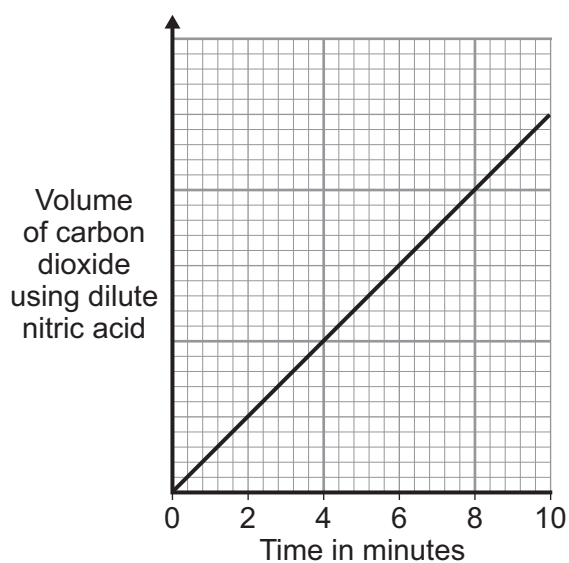
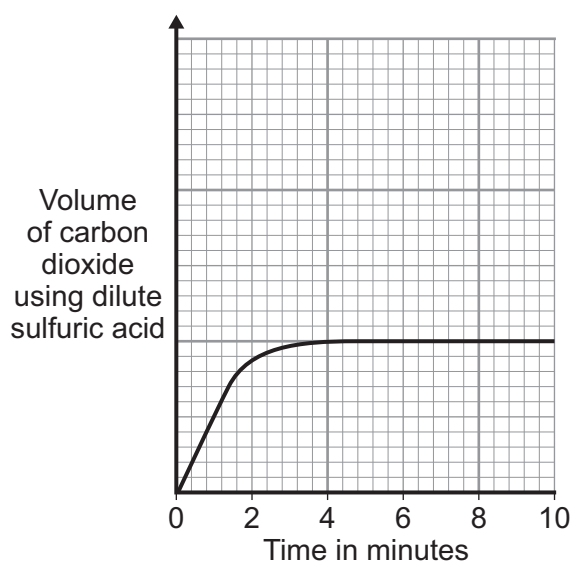
A student investigated the reaction of these two acids with calcium carbonate (limestone).

The type of acid was changed but all other variables were kept the same.

The student measured the volume of carbon dioxide produced each minute for a total of 10 minutes. He did this first for the reaction between dilute sulfuric acid and a cube of calcium carbonate (limestone).

The student repeated the experiment using dilute nitric acid in place of the dilute sulfuric acid.

The results are shown below.



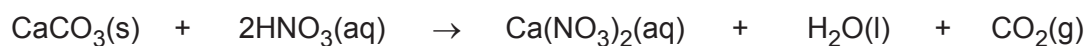
6 (b) (i) State **two** variables that must be kept the same for this investigation.

.....  
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(2 marks)

6 (b) (ii) Reacting calcium carbonate with sulfuric acid gave different results to nitric acid.

The symbol equations for the reaction of calcium carbonate with sulfuric acid and with nitric acid are shown below.



Describe how the results for sulfuric acid are different **and** use the symbol equations to explain this difference.

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(3 marks)

7
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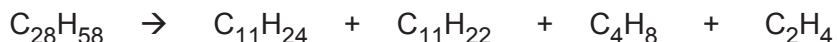
Turn over for the next question

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7 Ethene is used as a starting material for the production of many other substances, including ethanol.

7 (a) Ethene is produced when hydrocarbons are cracked. To do this hydrocarbons are heated to vaporise them. The vapours are then passed over a hot catalyst. The symbol equation shows the reaction for one hydrocarbon.



7 (a) (i) One of the products is a different type of hydrocarbon to the other products.

Complete the sentences.

The formula of the product that is a different type of hydrocarbon is .....

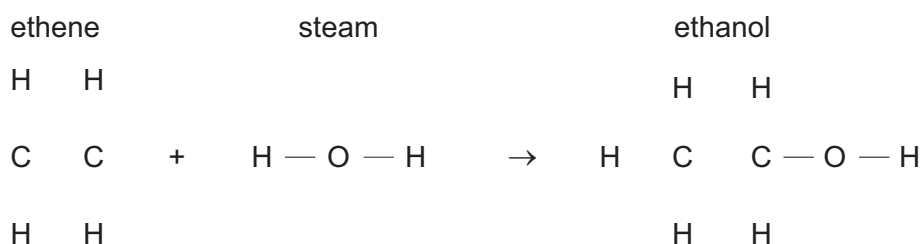
The chemical structure of this product is different to the other products because

.....  
.....

(2 marks)

7 (a) (ii) Ethanol is produced when ethene reacts with steam in the presence of a hot catalyst.

Draw the missing bonds to complete the displayed structures in the equation.



(2 marks)

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

In 1970, the Brazilian Government had stated that all petrol must contain more than 25% ethanol. The reasons for this statement in 1970 were:

- the oilfields in Brazil at that time only supplied 20% of the crude oil needed to make petrol
- Brazil has a climate suitable for growing sugar cane.

To produce ethanol the sugar cane plants are crushed and soaked in water for one day. The sugar solution is separated from the plant material by filtration. Yeast is added to the sugar solution and fermented for three days. The yeast is separated from the solution of water and ethanol by filtration. Ethanol is separated from water by fractional distillation.





In 2011, the Brazilian Government decided to reduce the amount of ethanol in petrol to 18%. The reasons were that in 2011:

- the demand for ethanol and the price of ethanol had greatly increased
- very large offshore oilfields had been discovered. These offshore oilfields would make Brazil one of the biggest crude oil producers in the world.

Use the information above and your own knowledge and understanding to evaluate whether Brazil should in future produce ethanol from crude oil or produce ethanol from sugar cane.

You should include environmental and economic or social factors in your evaluation.

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(6 marks)

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END OF QUESTIONS



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