

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
TWENTY FIRST CENTURY SCIENCE  
ADDITIONAL APPLIED SCIENCE A**

**A335/01**

Harnessing Chemicals  
(Foundation Tier)

**Thursday 15 January 2009  
Afternoon**

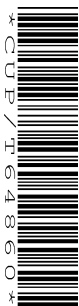
**Duration: 45 minutes**

Candidates answer on the question paper

**OCR Supplied Materials:**  
None

**Other Materials Required:**

- Pencil
- Ruler (cm/mm)



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

**INFORMATION FOR CANDIDATES**

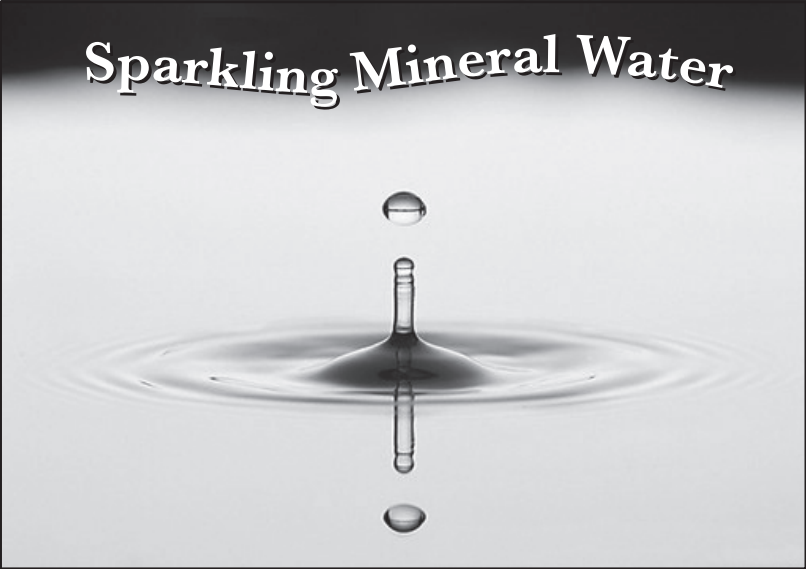
- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **36**.
- This document consists of **12** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	9	
2	6	
3	4	
4	5	
5	12	
<b>TOTAL</b>	<b>36</b>	

Answer **all** the questions.

- 1 Natural mineral water is formed when water filters through rocks and dissolves minerals.

The label below shows the minerals present in one type of sparkling mineral water.

<p><b>Ingredients</b> Natural Mineral Water, Carbon dioxide</p> <hr/> <p><b>Typical Mineral Analysis</b></p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 80%;"></th> <th style="text-align: right; font-weight: normal;">mg/litre</th> </tr> </thead> <tbody> <tr><td>Calcium</td><td style="text-align: right;">55</td></tr> <tr><td>Magnesium</td><td style="text-align: right;">4</td></tr> <tr><td>Sodium</td><td style="text-align: right;">30</td></tr> <tr><td>Potassium</td><td style="text-align: right;">8</td></tr> <tr><td>Chloride</td><td style="text-align: right;">19</td></tr> <tr><td>Fluoride</td><td style="text-align: right;">0</td></tr> <tr><td>Nitrate</td><td style="text-align: right;">0</td></tr> <tr><td>Sulfate</td><td style="text-align: right;">46</td></tr> <tr><td>Dry residue</td><td style="text-align: right;">162</td></tr> <tr><td>pH (at source)</td><td style="text-align: right;">8</td></tr> </tbody> </table>		mg/litre	Calcium	55	Magnesium	4	Sodium	30	Potassium	8	Chloride	19	Fluoride	0	Nitrate	0	Sulfate	46	Dry residue	162	pH (at source)	8	
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- (a) Mineral water is an example of a solution.

Why is mineral water an example of a **solution**?

.....

.....

..... [2]

- (b) Carbon dioxide is added to natural mineral water to make it sparkling.  
Some dissolves in the water to produce the weak acid, carbonic acid.

What effect does this have on the pH?

Put a tick (✓) in the box next to the **correct** answer.

pH increases

pH stays the same

pH decreases

[1]

(c) The elements in mineral water are present as salts.

(i) What is the symbol for magnesium?

..... [1]

(ii) Using the information from the label, give the name of two possible **salts** that the mineral water contains.

Put ticks (✓) in the boxes next to the **two** correct answers.

calcium nitrate

magnesium fluoride

potassium chloride

sodium nitrate

sodium sulfate

[2]

(iii) The dry residue for this sparkling mineral water is 162 mg/litre.  
To find this mass, 1 litre of the sparkling mineral water is evaporated.  
The solid which remains is weighed.

Name the apparatus which may be used to heat the water.

.....[1]

(iv) Edward buys a 250 ml bottle of the sparkling mineral water.

Use the label to find out how much sodium the water in this bottle contains.

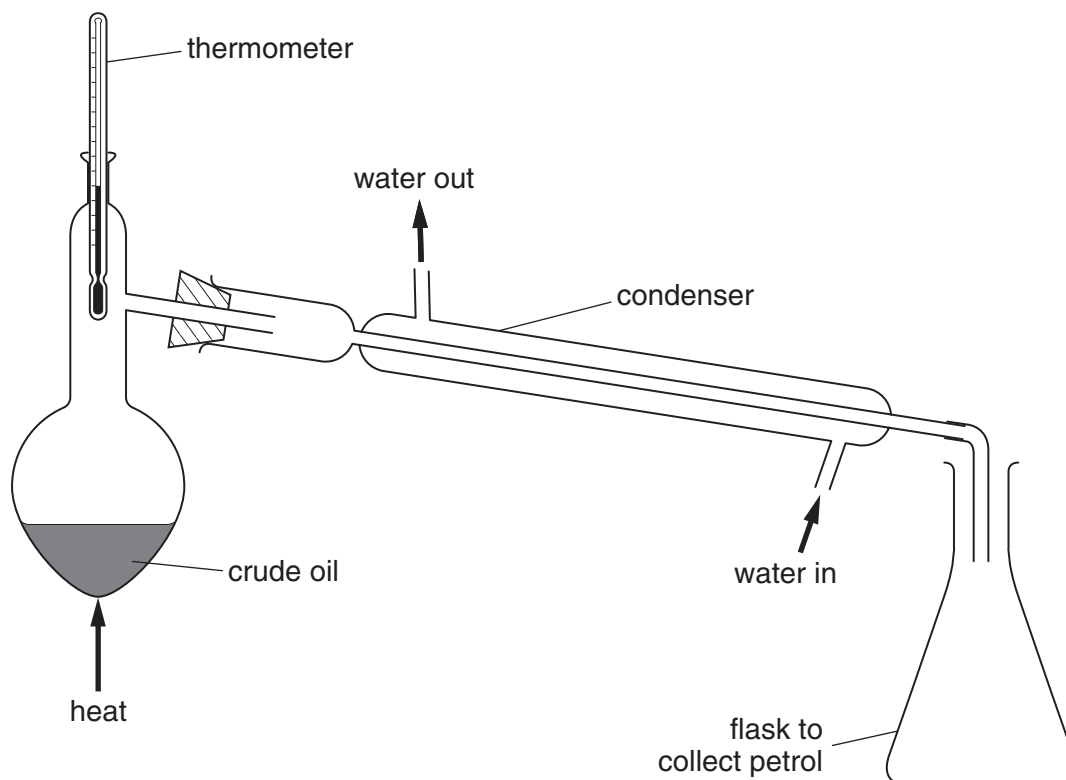
You are advised to show how you work out your answer.

sodium = .....mg [2]

[Total: 9]

2 Crude oil is a mixture of different hydrocarbons.

(a) Petrol can be separated from this mixture using the process of distillation.



In the laboratory the mixture is heated.

The petrol is collected at a temperature between 40–100°C.

What must the Petrol industry consider when they **scale up** this process at a refinery?

Put ticks (✓) in the boxes next to the **three best** answers.

Can petrol be distilled using a continuous process?

How can the crude oil be mixed?

How much energy is needed?

How can the workers be kept safe?

What is the petrol needed for?

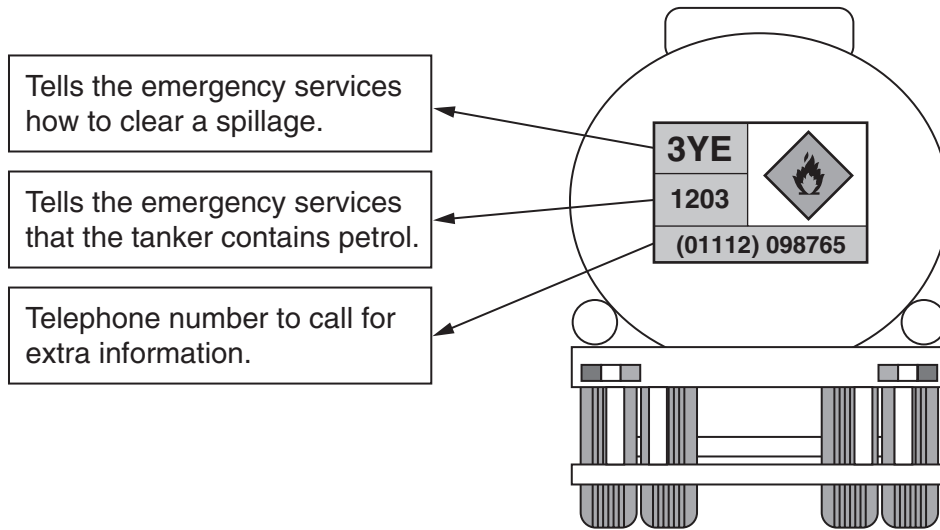
What colour is the petrol?

[3]

(b) Petrol is transported in road tankers.

By law tankers must be labelled with a Dangerous Goods Emergency Action Code.

Look at the label on the back of the tanker.



(i) What type of **hazard** is petrol?

Put a ring around the correct answer.

- corrosive**                      **highly flammable**                      **irritant**                      **toxic**

[1]

(ii) The code '3YE' tells the emergency services how to clear a spillage. It is important for the emergency services to know how to clear a spillage.

Give **two** reasons why.

.....

.....

..... [2]

[Total: 6]

- 3 Some people avoid food containing sugar.  
They choose food containing artificial sweeteners.

The table below compares two artificial sweeteners.

	<b>Saccharin</b>	<b>Sucralose</b>
formula	$C_7H_5NO_3S$	$C_{12}H_{19}O_8Cl_3$
raw materials needed to make the sweetener	coal or crude oil	sugar cane
how many times sweeter than sugar	300	600
energy in kCal	none	none

- (a) Saccharin has been in use for over 100 years.  
Sucralose was discovered in 1976.

Look at the information in the table.

Suggest **two** advantages of using Sucralose instead of Saccharin.

.....  
 .....  
 .....  
 ..... [2]

- (b) Sucralose has only been in use since 1998.

Suggest why it was several years before its use was permitted in food.

.....  
 ..... [1]

- (c) What type of chemicals are artificial sweeteners?

Put a **ring** around the correct answer below.

**batch**

**bulk**

**fine**

**small**

[1]

[Total: 4]

- 4 Bryony finds out about some important chemicals used in industry. She summarises her findings in the table below.

chemical name	chemical formula
ammonia	$\text{NH}_3$
ethanoic acid	$\text{CH}_3\text{COOH}$
ethanol	$\text{C}_2\text{H}_5\text{OH}$
nitric acid	
calcium carbonate	$\text{CaCO}_3$

- (a) The formula for nitric acid is missing.

Choose the correct formula for nitric acid from this list.  
Write your answer in the table.

**Na**      **N<sub>2</sub>**      **HNO<sub>3</sub>**      **NH<sub>4</sub>Cl**

[1]

- (b) Choose chemicals from the table to answer the following questions.

Each chemical may be used once, more than once, or not at all.

- (i) Which chemical formula contains **nine** atoms?

.....[1]

- (ii) Which chemical formula contains only **two** elements?

.....[1]

- (iii) Which **two** chemicals react together to produce the ester,  $\text{CH}_3\text{COOC}_2\text{H}_5$ ?

..... and .....[2]

[Total: 5]

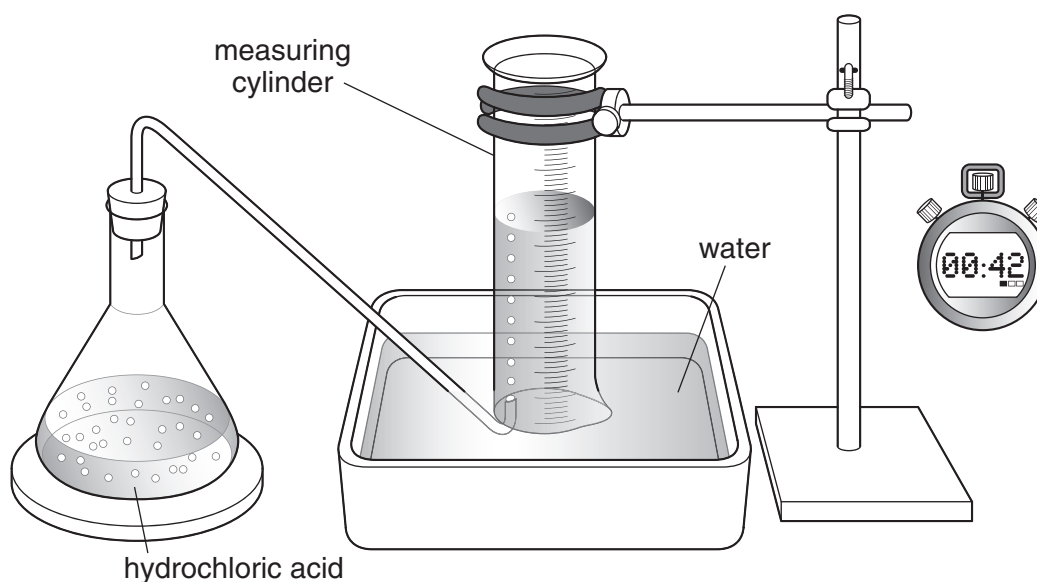
- 5 Yemi follows a standard procedure to find the rate of reaction between marble chips and hydrochloric acid.

Marble is calcium carbonate.

**step 1** Add approximately 50 cm<sup>3</sup> of hydrochloric acid to a conical flask.

**step 2** Weigh out approximately 3g of medium-sized marble chips.

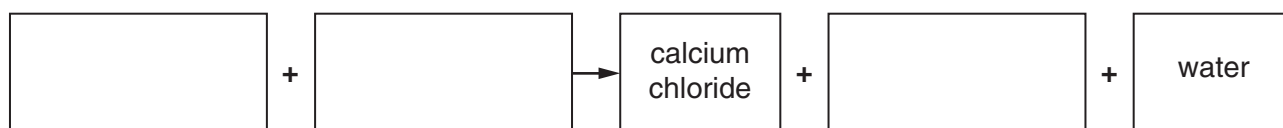
**step 3** Set up the apparatus as shown in the diagram.



**step 4** Transfer the marble chips to the conical flask. Start the stopwatch and quickly replace the bung and delivery tube.

**step 5** Record the volume of gas collected in the measuring cylinder every minute until the reaction stops.

(a) Complete the word equation for the reaction between calcium carbonate and hydrochloric acid to produce calcium chloride, water and a named gas.



[2]



(b) What piece of equipment should Yemi use to measure out the hydrochloric acid?

.....[1]

(c) Why is it important that the bung is replaced quickly once the marble chips have been added to the conical flask?

.....  
.....[1]

(d) How will Yemi know when the reaction has stopped?

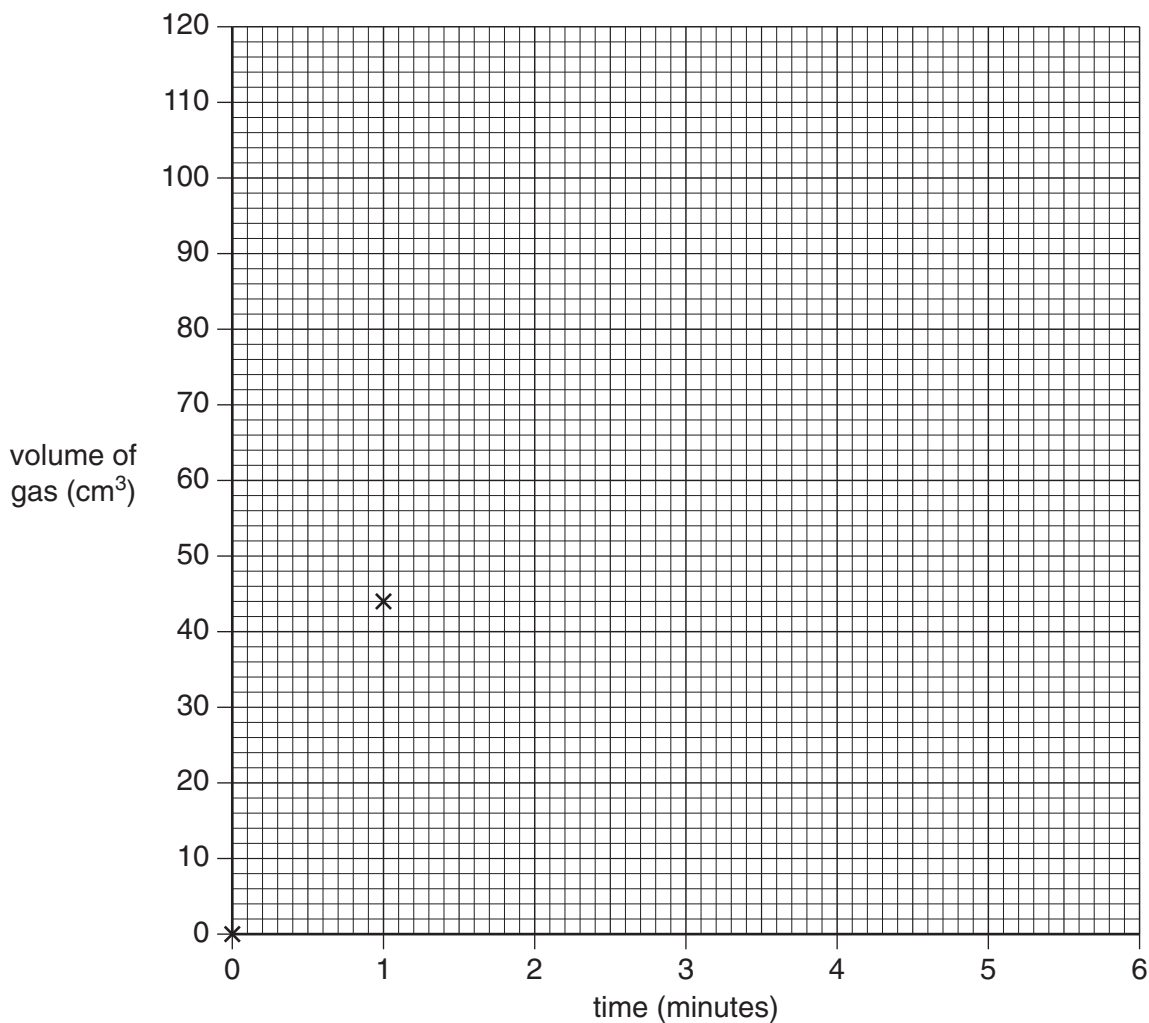
.....  
.....[1]

(e) The results that Yemi collected from this experiment are shown in the table below.

time (minutes)	0	1	2	3	4	5	6
volume of gas (cm <sup>3</sup> )	0	44	70		98	102	102

(i) Plot these results on this grid. The first two have been done for you.

[2]



(ii) Finish the graph by drawing the line or curve of best fit through the points.

[1]

(iii) Yemi forgot to take a measurement at three minutes.

**Use the graph** to find the volume of gas collected at three minutes.  
Record your value in the table.

[1]

- (iv) Show on the graph where the reaction is **fastest**.

Label this **A**. [1]

- (v) The experiment was repeated using 3 g of **powdered** calcium carbonate with the same volume of acid, at the same temperature.

On your graph draw the line or curve that you would expect for this reaction.

Label this **B**. [2]

[Total: 12]

**END OF QUESTION PAPER**

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