

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GCSE**

**B742/01**

**GATEWAY SCIENCE  
CHEMISTRY B**

**Chemistry modules C4, C5, C6  
(Foundation Tier)**

**MONDAY 20 JUNE 2016: Morning**

**DURATION: 1 hour 30 minutes  
plus your additional time allowance  
MODIFIED ENLARGED 24pt**

<b>Candidate forename</b>						<b>Candidate surname</b>				
<b>Centre number</b>						<b>Candidate number</b>				

**Candidates answer on the Question Paper.  
A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:  
A copy of the Periodic Table**

**OTHER MATERIALS REQUIRED:  
Pencil  
Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**



## **INSTRUCTIONS TO CANDIDATES**

**Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**

**Use black ink. HB pencil may be used for graphs and diagrams only.**

**Answer ALL the questions.**

**Read each question carefully. Make sure you know what you have to do before starting your answer.**

**Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.**

## **INFORMATION FOR CANDIDATES**

**The quality of written communication is assessed in questions marked with a pencil (.**

**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 85.**

**Any blank pages are indicated.**

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Answer ALL the questions.

SECTION A – Module C4

1 Look at the table. It shows some information about three atoms.

Atom	Number of protons	Number of neutrons	Electronic structure
X	17	20	2.8.7
Y	17	18	2.8.7
Z	3	4	2.1

(a) (i) What is the ATOMIC NUMBER of atom X?

answer \_\_\_\_\_ [1]

(ii) What is the MASS NUMBER of atom Z?

answer \_\_\_\_\_ [1]

(iii) How many electron shells are occupied in atom Y?

answer \_\_\_\_\_ [1]

(b) Atoms X and Y are ISOTOPES.

What is meant by isotopes?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]

[TOTAL: 5]

**2 This question is about two Group 1 elements, sodium and potassium.**

**(a) Write down the name of ONE OTHER Group 1 element.**

\_\_\_\_\_ **[1]**

**(b) Sodium reacts with water.**

**Describe what you would SEE when sodium reacts with water.**

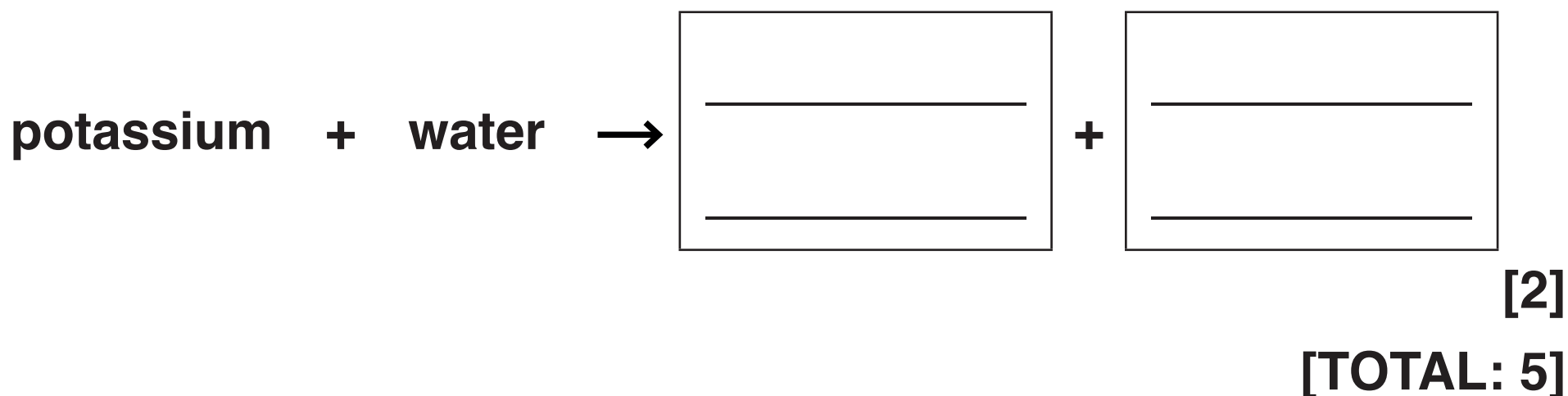
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ **[2]**

**(c) Potassium reacts with water.**

**One of the substances made is an alkali.**

**The other substance made burns with a ‘pop’.**

**Complete the WORD equation for this reaction.**



**3 This question is about the Periodic Table.**

**Look at the list of elements.**

**aluminium**

**boron**

**bromine**

**helium**

**potassium**

**silver**

**Answer these questions.**

**Use the copy of the Periodic Table to help you.**

**Choose your answers from the list.**

**(a) (i) Two elements are in the same GROUP of the Periodic Table.**

**Which two elements?**

\_\_\_\_\_ and \_\_\_\_\_ **[1]**

**(ii) Two elements are in the same PERIOD of the Periodic Table.**

**Which two elements?**

\_\_\_\_\_ and \_\_\_\_\_ **[1]**

**(iii) Write down the name of a TRANSITION element.**

\_\_\_\_\_ **[1]**

**(b) One scientist who helped to develop the Periodic Table was called Mendeleev.**

**Write about how Mendeleev helped in the development of the Periodic Table.**

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[2]

**[TOTAL: 5]**

**4 Jed is testing potassium chloride and some unknown compounds.**

**He does some tests.**

**These are the tests that Jed does on solutions of the compounds:**

**a flame test**

**adding sodium hydroxide solution**

**adding silver nitrate solution.**

**Look at his results.**

<b>COMPOUND</b>	<b>FLAME COLOUR</b>	<b>ADDING SODIUM HYDROXIDE SOLUTION</b>	<b>ADDING SILVER NITRATE SOLUTION</b>
<b>potassium chloride</b>	<b>lilac</b>	<b>no reaction</b>	<b>white solid made</b>
<b>A</b>	<b>yellow</b>	<b>no reaction</b>	<b>white solid made</b>
<b>B</b>	<b>no colour</b>	<b>green solid made</b>	<b>cream solid made</b>

**Potassium chloride reacts with silver nitrate to make silver chloride and potassium nitrate.**

**Write a WORD equation for this reaction.**

**Identify the unknown compounds A and B and explain your answers.** [6]





**[TOTAL: 6]**

**5 This question is about the Group 7 elements.**

**Chlorine and iodine are Group 7 elements.**

**(a) What is the name given to the Group 7 elements?**

\_\_\_\_\_ **[1]**

**(b) (i) Write down TWO uses of chlorine.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ **[2]**

**(ii) Write down ONE use of iodine.**

\_\_\_\_\_  
\_\_\_\_\_ **[1]**

**[TOTAL: 4]**

**SECTION B – Module C5**

**6 Orange squash is a concentrated solution.**

**It has to be diluted with water to make sure that the taste is not too strong.**

**(a) Some medicines and baby milk both need to be diluted before they are used.**

**Explain why some medicines and baby milk both need to be diluted.**

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[2]

**(b) Orange juice contains vitamin C.**

**The formula for vitamin C is  $C_6H_8O_6$ .**

**A sample of 176 g of vitamin C contains 72 g of carbon and 8 g of hydrogen.**

**How many grams of oxygen does it contain?**

answer \_\_\_\_\_ g

[1]

**[TOTAL: 3]**

**7 Kate and Steve are testing some water samples.**

**They use lead nitrate solution and barium chloride solution.**

**They add each solution to different samples of water.**

**Look at the table. It shows their results.**

<b>WATER SAMPLE</b>	<b>EFFECT OF ADDING LEAD NITRATE SOLUTION</b>	<b>EFFECT OF ADDING BARIUM CHLORIDE SOLUTION</b>
<b>A</b>	<b>white precipitate</b>	<b>no reaction</b>
<b>B</b>	<b>yellow precipitate</b>	<b>white precipitate</b>
<b>C</b>	<b>no reaction</b>	<b>white precipitate</b>

## Which negative ions are in each water sample?

## Explain your answers.

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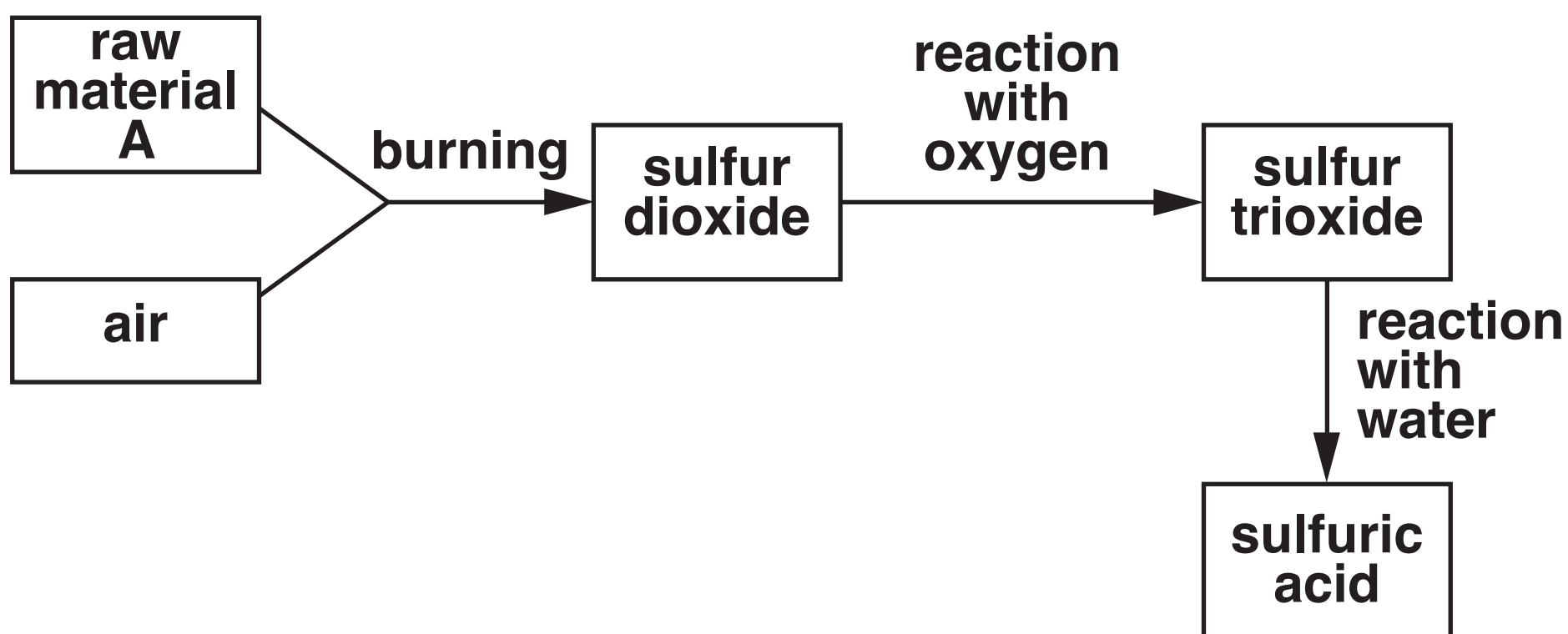
[4

**[4]**

**[TOTAL: 4]**

- 8 This question is about the Contact Process used for the manufacture of sulfuric acid.

Look at the flow chart for the process.



- (a) What is the name of raw material A?

\_\_\_\_\_ [1]

- (b) In the process, sulfur dioxide,  $\text{SO}_2$ , reacts with oxygen,  $\text{O}_2$ , to make sulfur trioxide,  $\text{SO}_3$ .

Write the **BALANCED SYMBOL** equation for this reaction.

\_\_\_\_\_ [2]

**(c) Look at the table.**

**It shows how the percentage yield of sulfur trioxide changes as the temperature changes.**

<b>Temperature in °C</b>	<b>Percentage (%) yield of sulfur trioxide</b>
<b>200</b>	<b>98</b>
<b>400</b>	<b>90</b>
<b>600</b>	<b>47</b>
<b>800</b>	<b>18</b>
<b>1000</b>	<b>5</b>

**(i) How does DECREASING the temperature affect the percentage yield?**

\_\_\_\_\_ **[1]**

**(ii) Estimate the percentage yield of sulfur trioxide at 700 °C.**

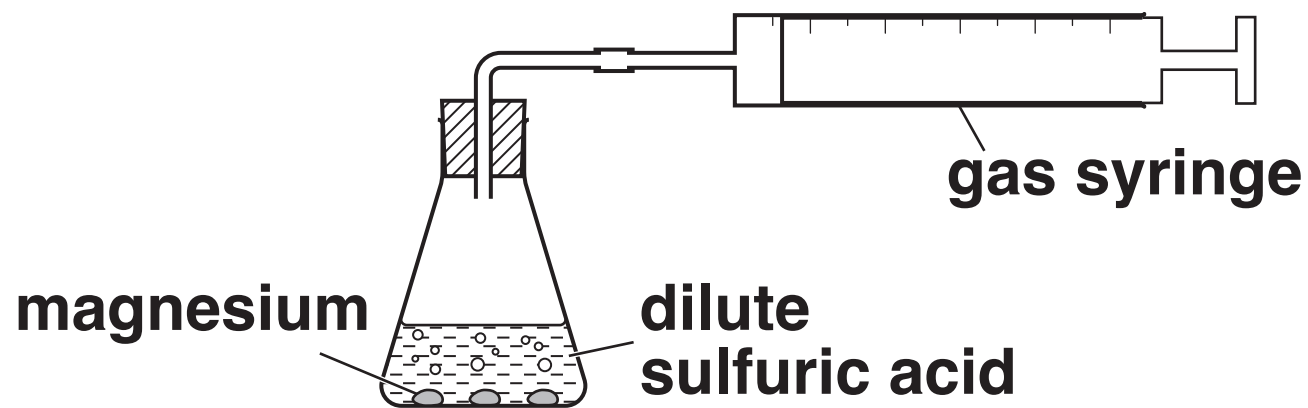
**answer** \_\_\_\_\_ **%** **[1]**

**[TOTAL: 5]**

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9 Hayley and Andy investigate the reaction between magnesium and sulfuric acid.

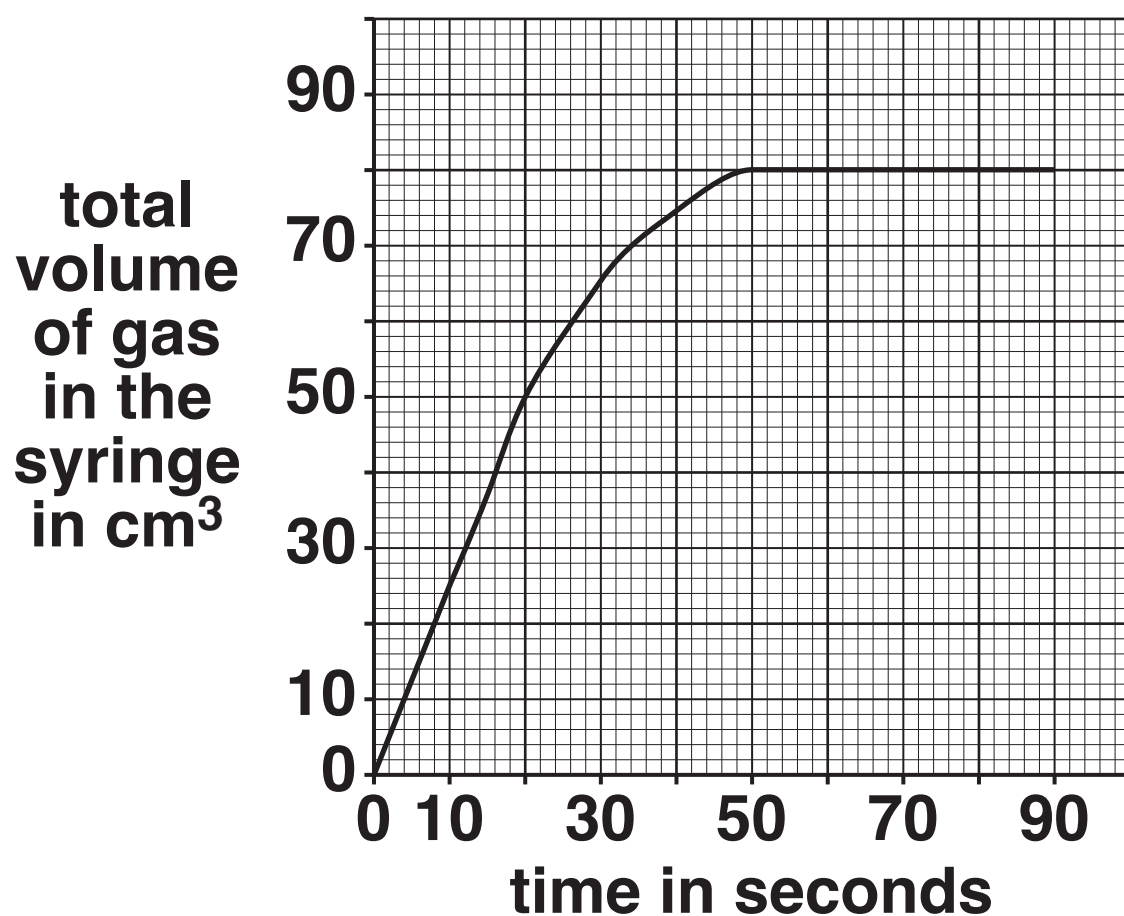
Look at the diagram. It shows the apparatus they use.



They add 0.1 g of magnesium to 50 cm<sup>3</sup> of sulfuric acid.

They measure the total volume of gas in the syringe every 10 seconds.

Look at the graph of their results.





**(a) (i) What is the total volume of gas in the syringe after 20 seconds?**

**answer \_\_\_\_\_ cm<sup>3</sup> [1]**

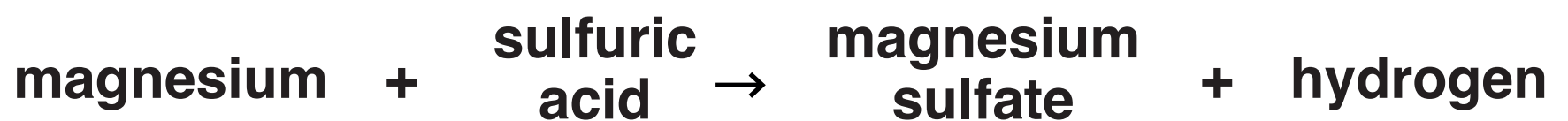
**(ii) How long does it take for the reaction to stop?**

**answer \_\_\_\_\_ seconds [1]**

**(b) Explain why the reaction stops.**

\_\_\_\_\_  
\_\_\_\_\_ [1]

(c) Look at the equation for the reaction.



Hayley and Andy investigate this reaction with different masses of magnesium.

They calculate the mass of sulfuric acid used and the masses of magnesium sulfate and hydrogen made.

Mass of magnesium in g	Mass of sulfuric acid in g	Mass of magnesium sulfate in g	Mass of hydrogen in g
0.50	2.04	2.50	0.04
1.00	4.08	5.00	0.08
1.50		7.50	0.12
2.00	8.16	10.00	

(i) Complete the table. [2]

(ii) Calculate the mass of magnesium sulfate made if 10 g of magnesium completely reacts with sulfuric acid.

Explain how you worked out your answer.

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\_\_\_\_\_ [2]

[TOTAL: 7]

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## 10 Stewart and Claire want to do a titration.

Look at the diagrams. They show some of the apparatus they use.

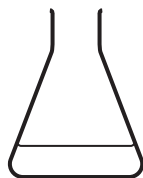
burette



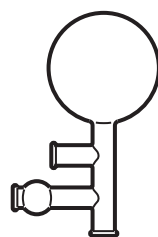
pipette



flask



pipette filler



They want to titrate dilute hydrochloric acid with dilute sodium hydroxide solution.

Describe, in detail, how they do the titration. Include any safety precautions they should take.

You may wish to draw a labelled diagram to help your answer.

[6]



The quality of written communication will be assessed in your answer to this question.

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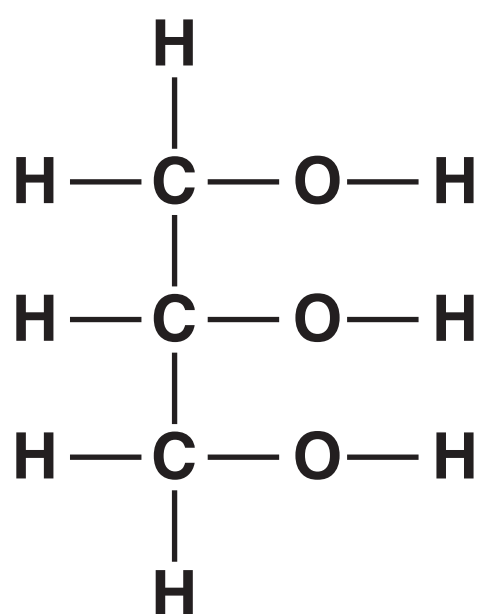
**[TOTAL: 6]**

## SECTION C – Module C6

### 11 Fats are compounds called esters.

Fats are made by the reaction between an alcohol called glycerol and carboxylic acids.

(a) Look at the displayed formula of a molecule of glycerol.



(i) Look at the molecular formula for glycerol.



What are the numbers for x, y and z in the formula?

x = \_\_\_\_\_

y = \_\_\_\_\_

z = \_\_\_\_\_

[1]

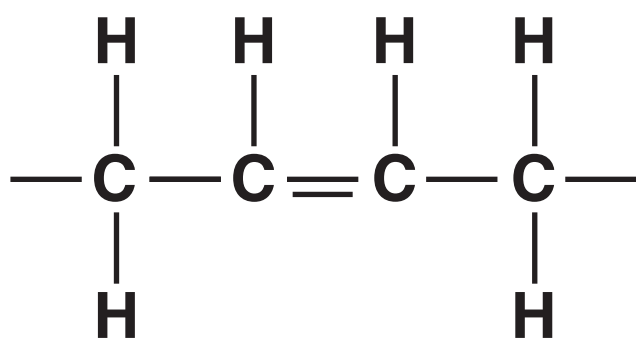
(ii) Glycerol is NOT a hydrocarbon.

How can you tell from its formula?

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

[1]

**(b) Look at part of the displayed formula of a fat.**



**The fat is UNSATURATED.**

**(i) How can you tell from its formula?**

\_\_\_\_\_

\_\_\_\_\_ **[1]**

**(ii) Dave does a chemical test to show that the fat is unsaturated.**

**Write about the chemical test and the result Dave gets.**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ **[2]**

**(c) Write down TWO large scale uses of fats.**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ **[2]**

**[TOTAL: 7]**

**12 Thirty years ago CFCs were used as refrigerants and aerosol propellants.**

**Nowadays the use of CFCs in the United Kingdom has been banned.**

**Write about some of the properties of CFCs that made them suitable as aerosol propellants.**

**Explain why the use of CFCs has now been banned in the United Kingdom. [6]**



**The quality of written communication will be assessed in your answer to this question.**

[illegible]




**[TOTAL: 6]**

**13 Colin investigates some displacement reactions.**

**He puts a small sample of metal powder into a salt solution.**

**Colin does five different experiments.**

**Look at his results.**

		Colour of solution	
Metal	Salt solution	At start	At end
magnesium	iron(II) sulfate	green	colourless
iron	copper(II) sulfate	blue	green
copper	iron(II) sulfate	green	green
magnesium	copper(II) sulfate	blue	colourless
copper	silver nitrate	colourless	blue

**(a) Which mixture of metal and salt solution does NOT react?**

**Explain your answer.**

[2]

**(b) Predict the order of reactivity of the metals, copper, iron, magnesium and silver.**

**Put the most reactive metal first.**

**most reactive** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**least reactive** \_\_\_\_\_

**Explain your answer.**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ **[3]**

**[TOTAL: 5]**

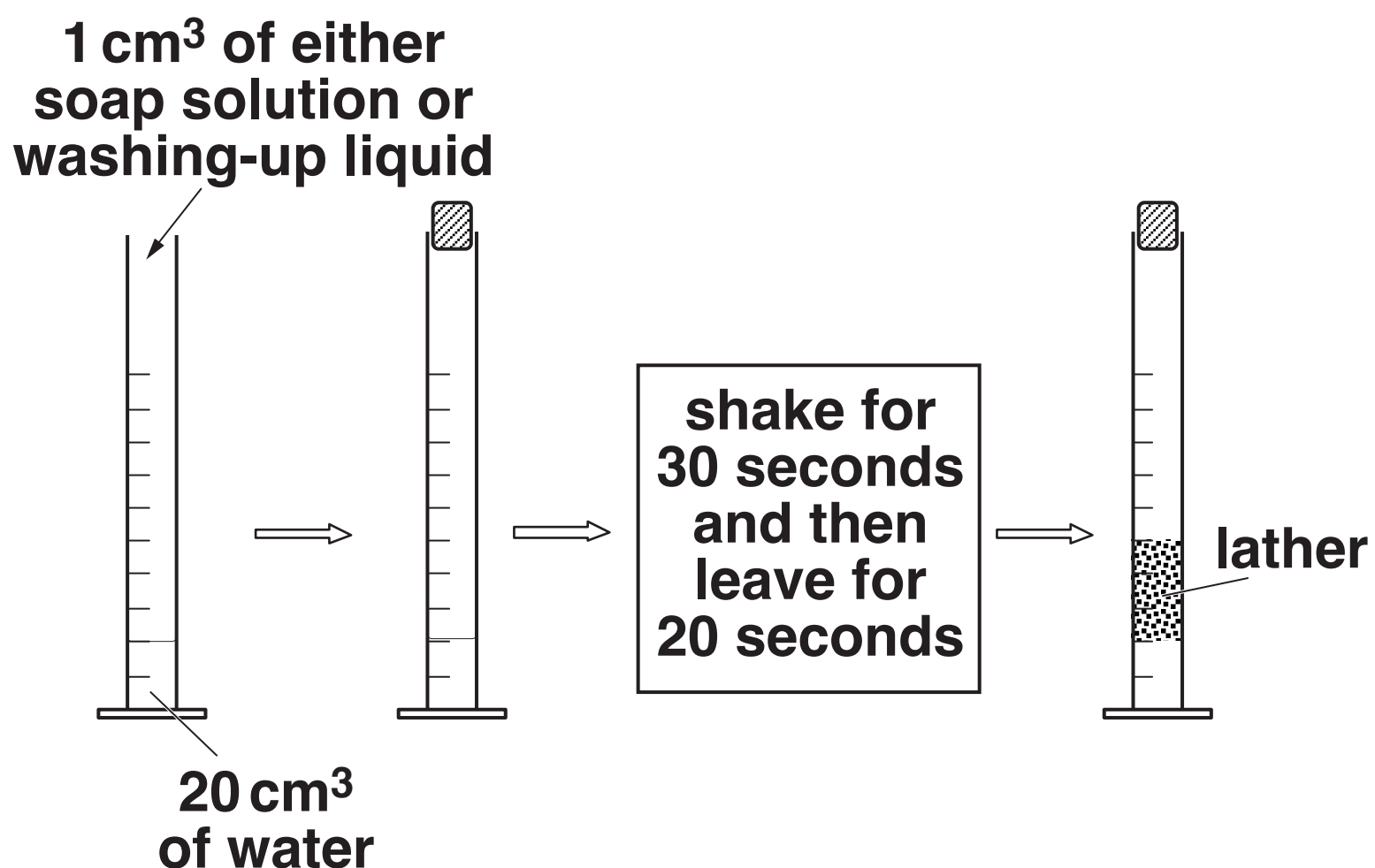
**14 Magda and Sam investigate soap solution and washing-up liquid.**

**In their first experiment they measure out  $20\text{ cm}^3$  of a water sample in a measuring cylinder.**

**They then add  $1\text{ cm}^3$  of soap solution to the water sample.**

**Magda shakes the measuring cylinder for 30 seconds.**

**Sam waits 20 seconds and then measures the volume of lather in the measuring cylinder.**



**Magda and Sam repeat this experiment using different water samples and soap solution.**

**They then repeat the experiments using washing-up liquid instead of soap solution.**

**Look at Magda and Sam's results.**

Water sample	Volume of lather with soap solution in cm <sup>3</sup>	Volume of lather with washing-up liquid in cm <sup>3</sup>
distilled water	30	60
water with only permanent hardness	5	60
water with only temporary hardness	10	60
salt water	25	60

**Before she did the experiment, Magda predicted that water hardness affects the action of BOTH soap AND of washing-up liquid.**

## Is this prediction supported by the results?

**Explain your answer quoting data from the results table.**

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[2]

**[TOTAL: 2]**

**15 Molten (liquid) salts can be electrolysed.**

**(a) Molten (liquid) potassium chloride can be electrolysed.**

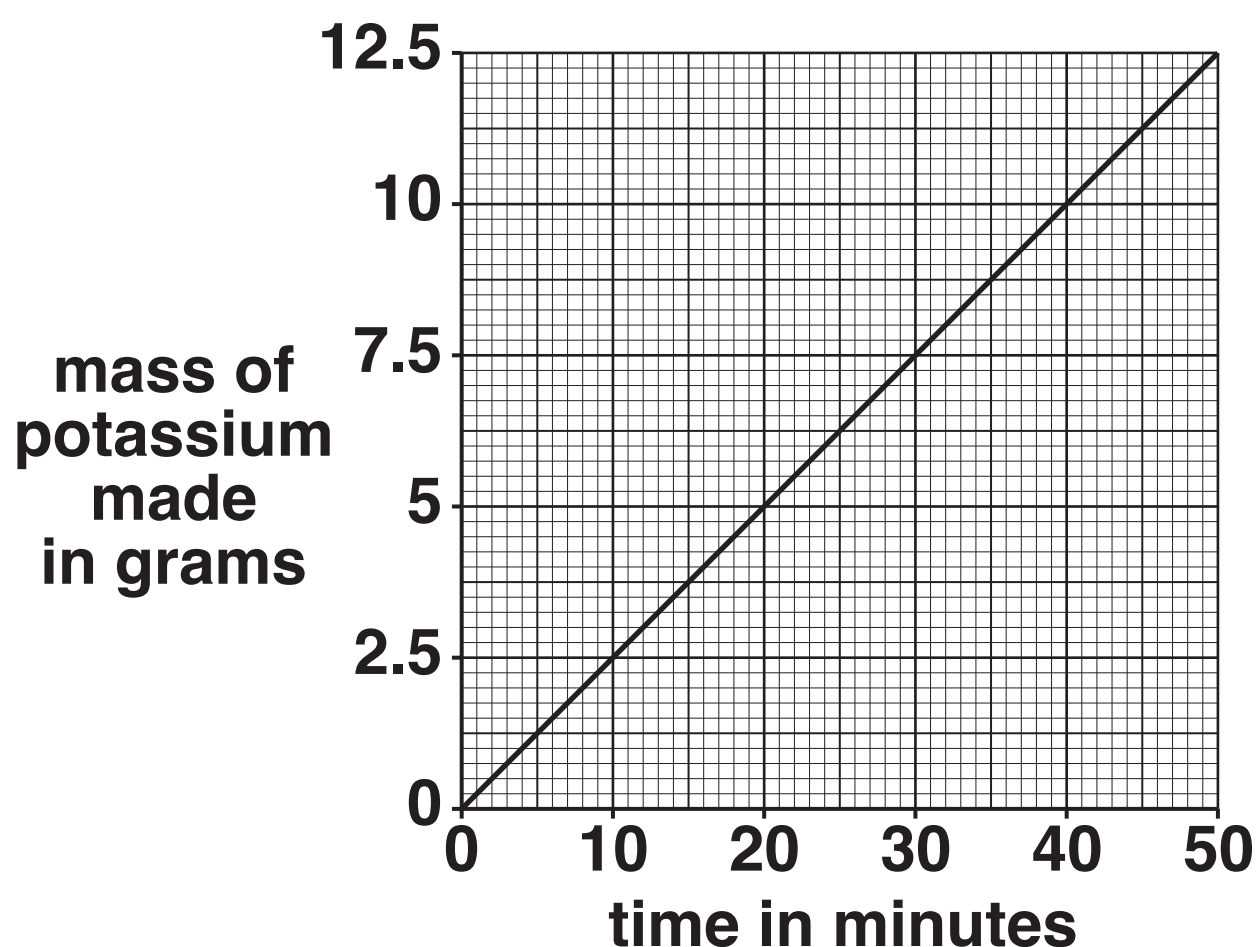
**It makes potassium.**

**Sanjay investigates the mass of potassium made when molten potassium chloride is electrolysed.**

**He always uses a current of 10.3 amps.**

**He changes how long, in minutes, he does the electrolysis.**

**Look at the graph of his results.**



**(i) What mass of potassium is made after 30 minutes?**

\_\_\_\_\_ g

**[1]**

**(ii) Sanjay electrolyses molten potassium chloride for 300 minutes.**

**Predict the mass of potassium made.**

\_\_\_\_\_ g

**30**

**[1]**

**(b) Sanjay does an electrolysis experiment using potassium bromide.**

**SOLID potassium bromide cannot be electrolysed.**

**MOLTEN (liquid) potassium bromide can be electrolysed.  
It makes two products.**

**(i) Write down the names of the TWO products made during this electrolysis.**

\_\_\_\_\_  
\_\_\_\_\_ **[2]**

**(ii) Explain why molten (liquid) potassium bromide can be electrolysed.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ **[1]**

**[TOTAL: 5]**

## SECTION D

### 16 Farmers use fertilisers to improve crop yield.

Fertilisers contain one or more of the three essential elements.

These essential elements are nitrogen, phosphorus and potassium.

Fertilisers made in factories are called **SYNTHETIC** fertilisers.

(a) Look at the graph on the next page.

It shows the use of some synthetic fertilisers in the UK between 1996 and 2006.

(i) What mass of fertilisers containing **NITROGEN** was used in 1997?

\_\_\_\_\_ thousands of tonnes [1]

(ii) Describe the general trend in the use of these synthetic fertilisers in the UK from 1996 to 2006.

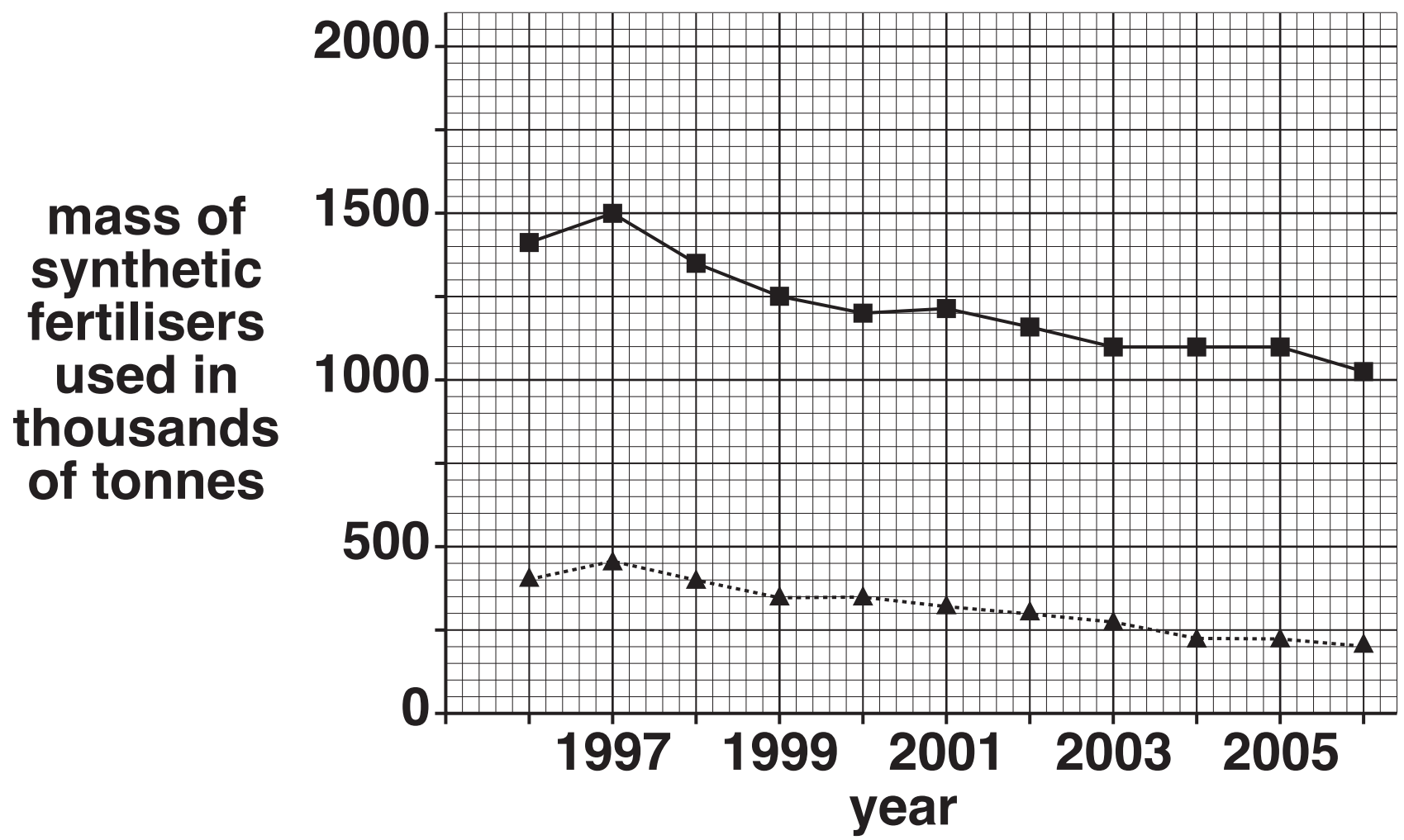
\_\_\_\_\_  
\_\_\_\_\_ [1]



## Key

■—■ fertilisers containing nitrogen (N)

▲.....▲ fertilisers containing phosphorus (P)



**(b) Look at the graph.**

**It shows the use of synthetic fertilisers in the world between the years 1950 and 2010.**

**Key**

**—— fertilisers containing nitrogen**

**..... fertilisers containing phosphorus**

Adapted from Dr J Floor Anthoni, Soil Fertility 2, 2000,  
[www.seafriends.org.nz/enviro/soil/fertile2](http://www.seafriends.org.nz/enviro/soil/fertile2). Item removed due to copyright restrictions.

Use the graphs in (a) and (b) to COMPARE the use of synthetic fertilisers in the UK and the world.

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[3]

**(c) Farmers also use PESTICIDES to increase crop yield.**

**Pesticides kill pests such as insects which eat the crops.**

**Look at the table. It shows the use of synthetic fertilisers and pesticides in some countries.**

<b>Country</b>	<b>Mass of synthetic fertilisers used in 1 km<sup>2</sup> in kg</b>	<b>Mass of pesticides used in 1 km<sup>2</sup> in kg</b>
<b>A</b>	<b>39 000</b>	<b>5100</b>
<b>B</b>	<b>59 000</b>	<b>200</b>
<b>C</b>	<b>45 000</b>	<b>900</b>
<b>D</b>	<b>8 000</b>	<b>500</b>
<b>E</b>	<b>6 000</b>	<b>200</b>

**(i) Some people want to buy organic vegetables.**

**Organic vegetables must be grown WITHOUT the use of synthetic fertilisers and pesticides.**

**From the information in the table, suggest a country, A, B, C, D or E which grows lots of organic vegetables.**

**Explain your answer.**

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[2]

**(ii) The land area of country B is 7 000 000 km<sup>2</sup>.**

**Calculate the mass of PESTICIDES used in country B.**

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**mass of pesticides = \_\_\_\_\_ kg [1]**

**(d) The use of synthetic fertilisers also contributes towards the greenhouse effect.**

**Look at the pie charts opposite about three greenhouse gases.**

**They show where these greenhouse gases come from.**

**Suggest which gas is most likely to be made from the use of synthetic fertilisers.**

**Choose from carbon dioxide, methane or nitrous oxide.**

**How can you tell?**

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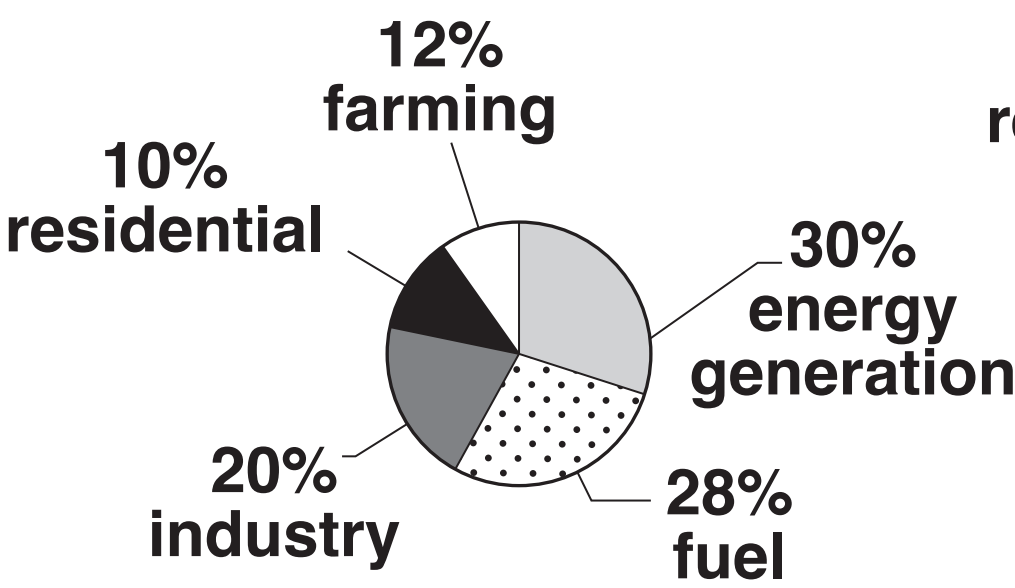
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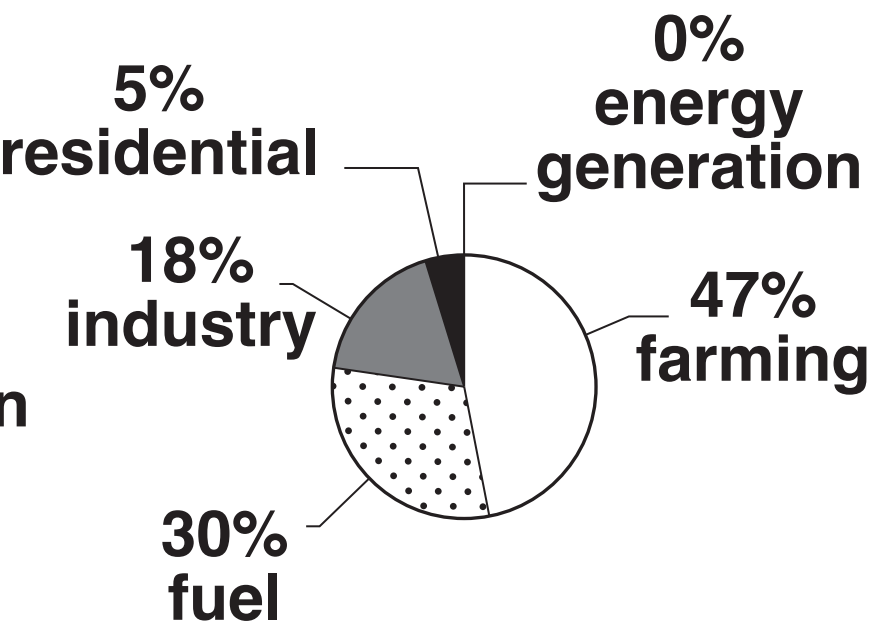
**[2]**

**[TOTAL: 10]**

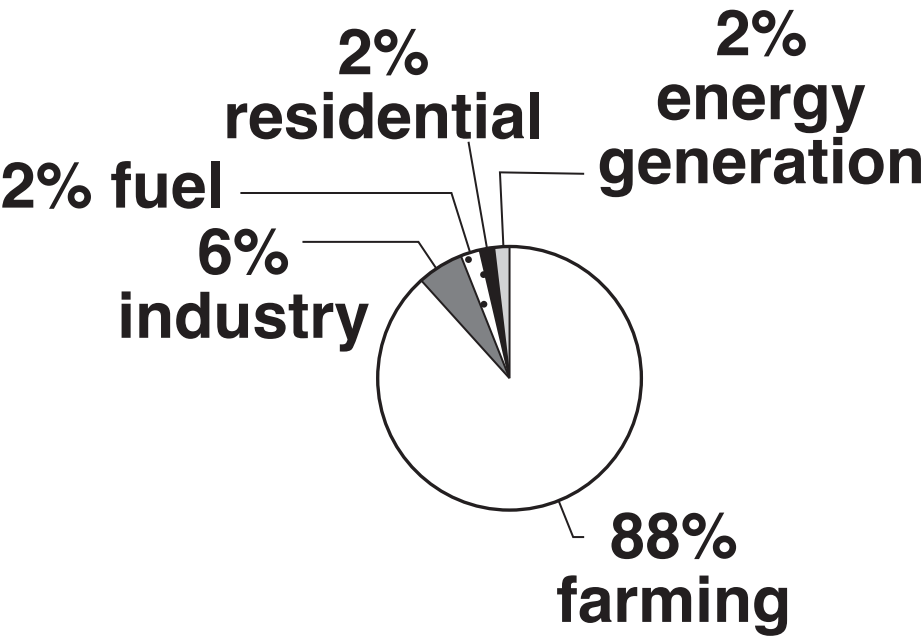
**CARBON DIOXIDE**



**METHANE**



**NITROUS OXIDE**



**END OF QUESTION PAPER**

### ADDITIONAL ANSWER SPACE

**If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margins.**

[illegible]








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