

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GCSE**

**B742/01**

**GATEWAY SCIENCE  
CHEMISTRY B**

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

**MONDAY 16 JUNE 2014: Morning**

**DURATION: 1 hour 30 minutes  
plus your additional time allowance**

**MODIFIED ENLARGED**

<b>Candidate forename</b>		<b>Candidate surname</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**Candidates answer on the Question Paper.  
A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:**

**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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**

## **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.**

**Answer ALL the questions.**

**SECTION A – Module C4**

**1 This question is about magnesium, Mg.**

**Use the Periodic Table to help you answer these questions.**

**(a) Write down the name of an element in the same GROUP as magnesium.**

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

**(b) Write down the name of an element in the same PERIOD as magnesium.**

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

**(c) The electronic structure of magnesium is 2.8.2.**

**What does this tell you about the GROUP and the PERIOD that magnesium is in?**

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

**[TOTAL: 4]**

**2 Look at the table opposite. It shows information about the halogens.**

**(a) Complete the table. [3]**

**(b) Bromine reacts with sodium. Sodium bromide is made.**

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

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

**[TOTAL: 4]**

<b>HALOGEN</b>	<b>FORMULA</b>	<b>COLOUR</b>	<b>STATE AT ROOM TEMPERATURE</b>	<b>USE</b>
<b>fluorine</b>	<b>F<sub>2</sub></b>	<b>pale yellow</b>	<b>gas</b>	<b>making sodium fluoride</b>
<b>chlorine</b>	<b>Cl<sub>2</sub></b>		<b>gas</b>	<b>making plastics</b>
<b>bromine</b>	<b>Br<sub>2</sub></b>	<b>brown</b>		<b>making medicines</b>
<b>iodine</b>	<b>I<sub>2</sub></b>	<b>grey</b>	<b>solid</b>	

**3 Most metals have these physical properties.**

**shiny**

**high melting point**

**high boiling point**

**(a) Write down TWO other physical properties that most metals have.**

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**[2]**

**(b) Kevin builds a lightweight racing bike.**

**He chooses a suitable metal for the bike frame.**

**Suggest THREE properties, other than cost, needed by the metal he chooses.**

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**[3]**

**[TOTAL: 5]**



**(b) John Dalton developed his work on an atomic theory in 1803.**

**J.J. Thomson and E. Rutherford made other discoveries about the atom.**

**Write about these OTHER discoveries.**

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**[2]**

**[TOTAL: 8]**



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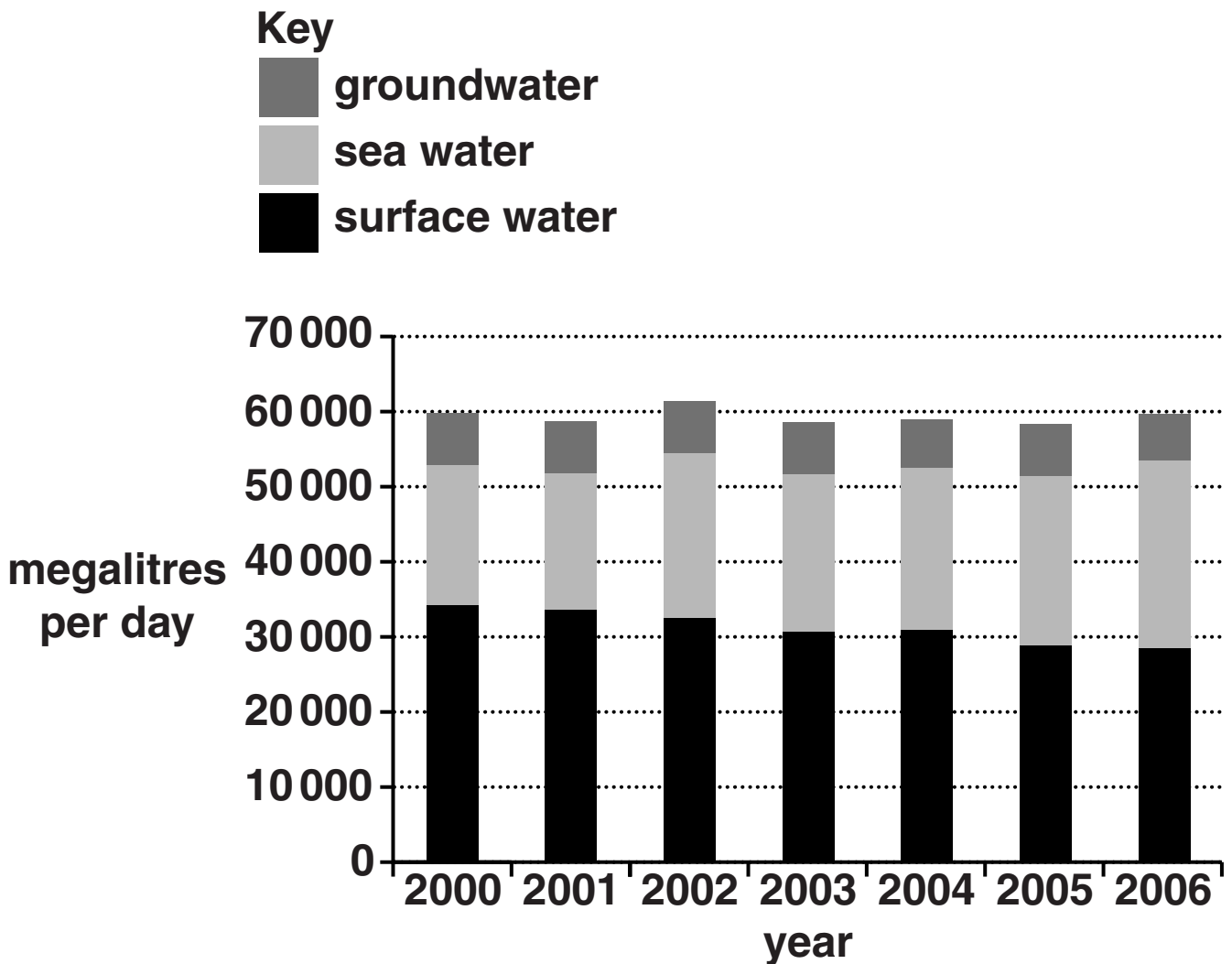
**5 This question is about how water is used in the UK.**

**(a) Look at the chart. It shows the volume of water taken per day in different years from:**

**groundwater – such as wells and aquifers**

**sea water – such as tidal rivers**

**surface water – such as rivers and lakes.**



**Sea water is mostly used as a coolant in power stations.**

**Surface water and groundwater are used to provide drinking water.**

**Look at the bar chart.**

**The volume of sea water taken has changed between the years 2000 and 2006.**

**Describe how, and suggest why, the volume of sea water changed.**

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**[2]**

**(b) Small amounts of pollutants are sometimes found in tap water in the UK.**

**Write down the names of TWO of these pollutants.**

**1** \_\_\_\_\_

**2** \_\_\_\_\_

**[2]**

**[TOTAL: 4]**

## **SECTION B – Module C5**

**6 This question is about acids and alkalis.**

**(a) Indicators change colour in acids and alkalis.**

**Look at the table opposite about some indicators.**

**Complete the table.**

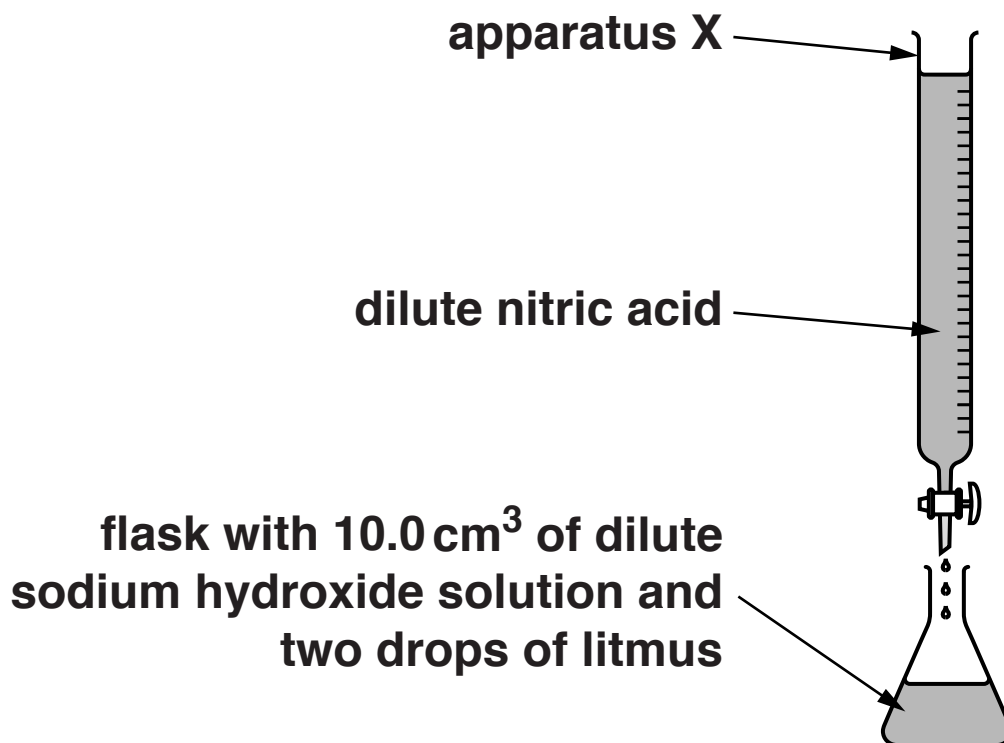
**[2]**

<b>INDICATOR</b>	<b>COLOUR IN</b>		
	<b>ACID</b>	<b>NEUTRAL</b>	<b>ALKALI</b>
<b>litmus</b>	<b>red</b>	<b>purple</b>	<b>blue</b>
<b>phenolphthalein</b>	<b>colourless</b>	<b>colourless</b>	
<b>universal indicator</b>	<b>red, orange or yellow</b>		<b>blue or purple</b>

**(b) Cristina does a titration.**

**She uses dilute nitric acid and an alkali called sodium hydroxide solution.**

**Look at the apparatus she uses.**



**(i) What is the name of apparatus X?**

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

- (ii) Cristina uses a pipette to measure the  $10.0\text{ cm}^3$  of sodium hydroxide solution.



Describe ONE safety precaution that Cristina takes when using the pipette.

Explain why this safety precaution is needed.

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[2]

**(iii) Cristina slowly adds dilute nitric acid to the flask.**

**She keeps adding the acid until all the sodium hydroxide is neutralised.**

**Write about how Cristina can tell when the sodium hydroxide has been neutralised.**

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**[2]**

**[TOTAL: 7]**



7 There are many compounds that contain carbon and hydrogen only.

(a) Pentane has the molecular formula  $C_5H_{12}$ .

Calculate the molar mass of pentane.

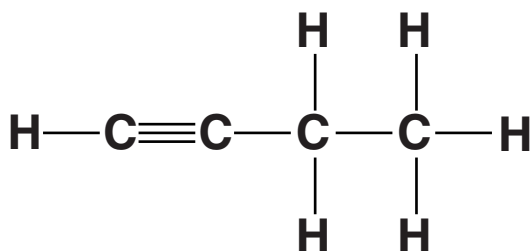
The relative atomic mass,  $A_r$ , of H = 1 and of C = 12.

\_\_\_\_\_

\_\_\_\_\_

molar mass = \_\_\_\_\_ g/mol [1]

(b) Look at the displayed formula for butyne.



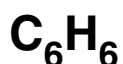
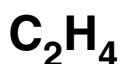
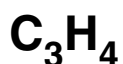
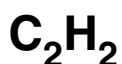
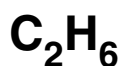
What is the MOLECULAR FORMULA for butyne?

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

(c) Look at the molecular formula of these compounds.

Which TWO compounds have the same EMPIRICAL formula?

Choose from



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

(d) David analyses a 1.6 g sample of methane,  $\text{CH}_4$ .

He finds it contains 1.2 g of carbon and 0.4 g of hydrogen.

Calculate the percentage by mass of CARBON in methane.

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

[TOTAL: 4]

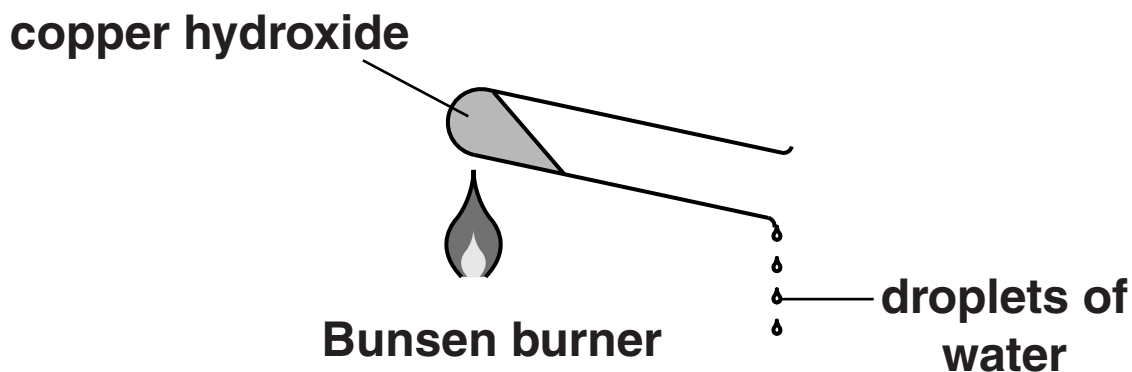
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**8 Copper hydroxide decomposes when heated. Copper oxide and water are made.**

**(a) Write down the WORD equation for this reaction.**

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

**(b) Jess heats some copper hydroxide. Look at the apparatus she uses.**



**She measures the mass of copper hydroxide at the start.**

**She then heats the copper hydroxide for 5 minutes. Jess lets the apparatus cool down.**

**She then measures the mass of copper oxide made.**

**Jess does the experiment three more times. Look at her results.**

<b>Experiment number</b>	<b>Mass of copper hydroxide in g</b>	<b>Mass of copper oxide made in g</b>	<b>Mass of water made in g</b>
<b>1</b>	<b>0.50</b>	<b>0.41</b>	<b>0.09</b>
<b>2</b>	<b>1.00</b>	<b>0.82</b>	<b>0.18</b>
<b>3</b>	<b>1.50</b>	<b>1.22</b>	
<b>4</b>	<b>2.00</b>	<b>1.63</b>	

**Jess predicts that the mass of water made depends on the mass of copper hydroxide heated.**

**Complete the results table.**

**Is Jess's prediction supported by her results?**

**Explain your answer.**

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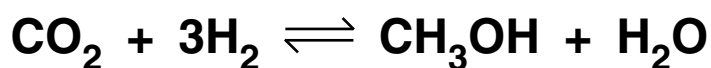
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**[3]**

**[TOTAL: 4]**

- 9 Carbon dioxide,  $\text{CO}_2$ , reacts with hydrogen,  $\text{H}_2$ , to make methanol,  $\text{CH}_3\text{OH}$ .



Phil investigates this reversible reaction.

He mixes carbon dioxide with hydrogen.

He lets this mixture reach equilibrium.

Phil measures the percentage yield of methanol in this equilibrium mixture.

He uses different temperatures and pressures.

Look at his results for different temperatures at a pressure of 100 atmospheres.

Temperature in °C	Percentage yield (%)
100	99
200	97
300	94
400	90

Look at his results for different pressures at a temperature of 400 °C.

Pressure in atmospheres	Percentage yield (%)
20	38
40	58
60	73
80	83
100	90

How does the percentage yield change with temperature and with pressure?

Describe how the percentage yield is linked to the position of equilibrium.



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

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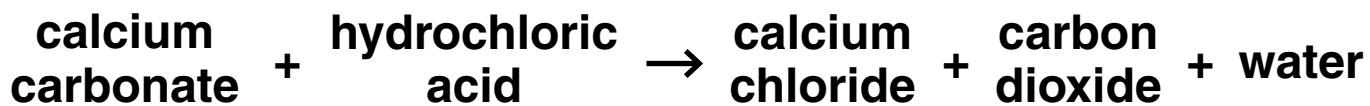
[6]

[TOTAL: 6]



## 10 Hydrochloric acid is a strong acid.

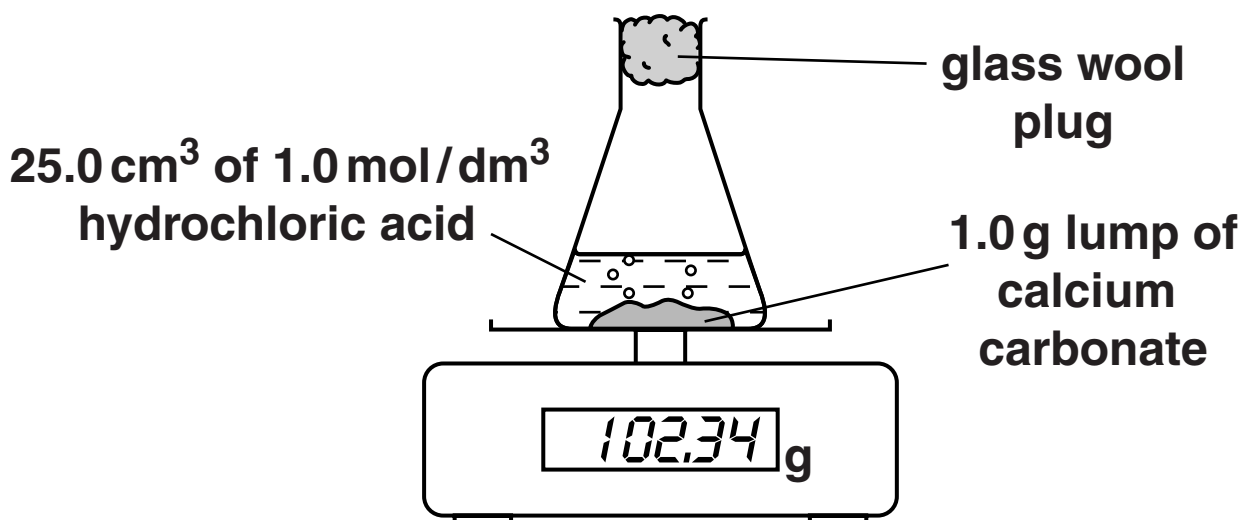
Hydrochloric acid reacts with calcium carbonate.



(a) Debbie places a 1.0 g lump of calcium carbonate into a flask.

She adds 25.0 cm<sup>3</sup> of 1.0 mol/dm<sup>3</sup> hydrochloric acid to the flask.

Debbie puts the flask on top of an electronic balance.



What happens to the reading on the balance during the reaction?

Explain your answer.

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[2]

**(b) Debbie repeats the experiment.**

**This time she uses 25.0 cm<sup>3</sup> of 1.0 mol/dm<sup>3</sup> ETHANOIC ACID instead of hydrochloric acid.**

**Her results are different this time.**

**How are the results different?**

**Explain your answer.**

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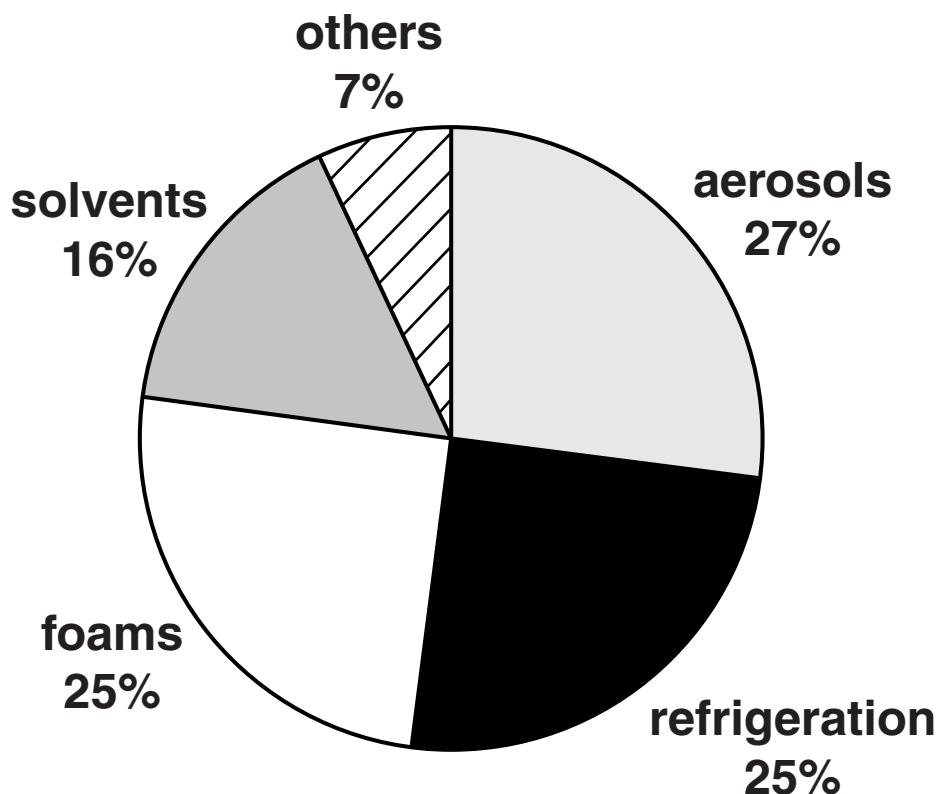
**[2]**

**[TOTAL: 4]**

## SECTION C – Module C6

11 This question is about CFCs.

(a) Look at the pie chart. It shows the uses of CFCs in 1986.



What was the **TOTAL** percentage of CFCs used to make aerosols **AND** foams in 1986?

answer \_\_\_\_\_ %

[1]

**(b) CFCs have now been replaced by HFCs.**

**The formula of one HFC is  $C_2H_2F_4$ .**

**(i) Write down the names of the three ELEMENTS in  $C_2H_2F_4$ .**

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

**(ii) Write down the TOTAL NUMBER OF ATOMS in one molecule of  $C_2H_2F_4$ .**

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

**(c) CFCs deplete the ozone layer.**

**This can result in medical problems.**

**Write about TWO of these problems.**

\_\_\_\_\_

\_\_\_\_\_

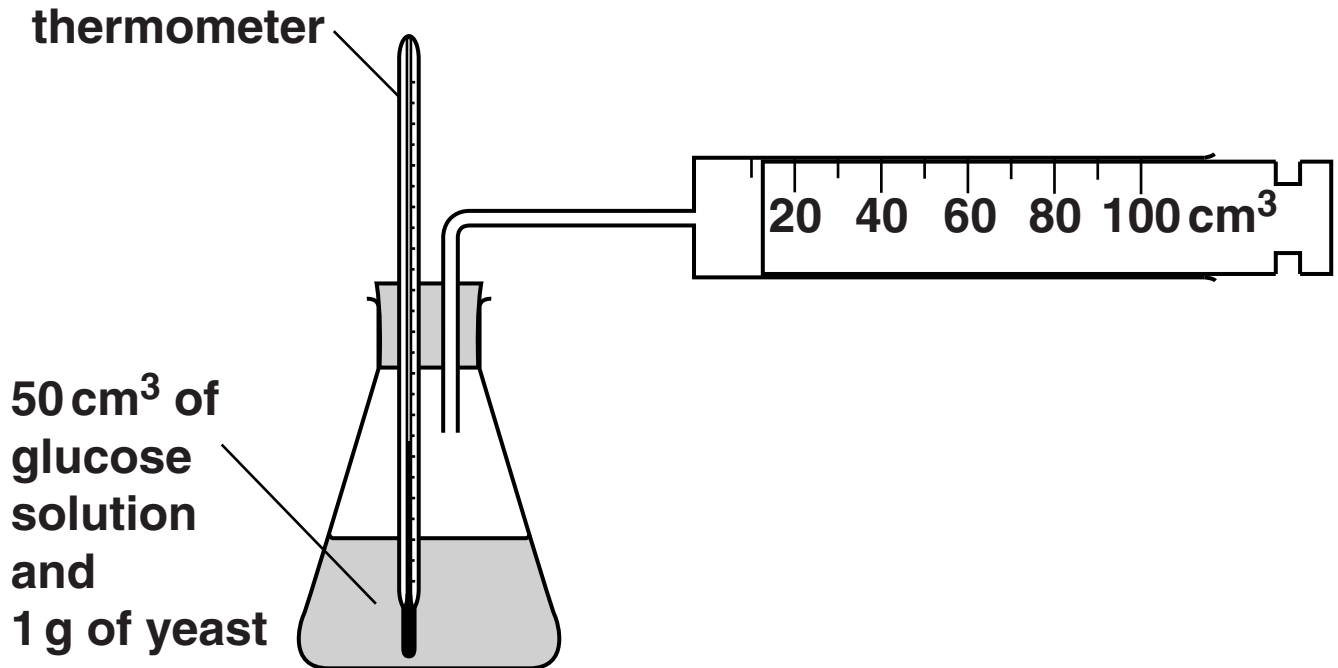
\_\_\_\_\_ [2]

**[TOTAL: 5]**

**12 Ethanol can be made by the fermentation of glucose.**

**Tina and Tommy investigate the fermentation of glucose.**

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

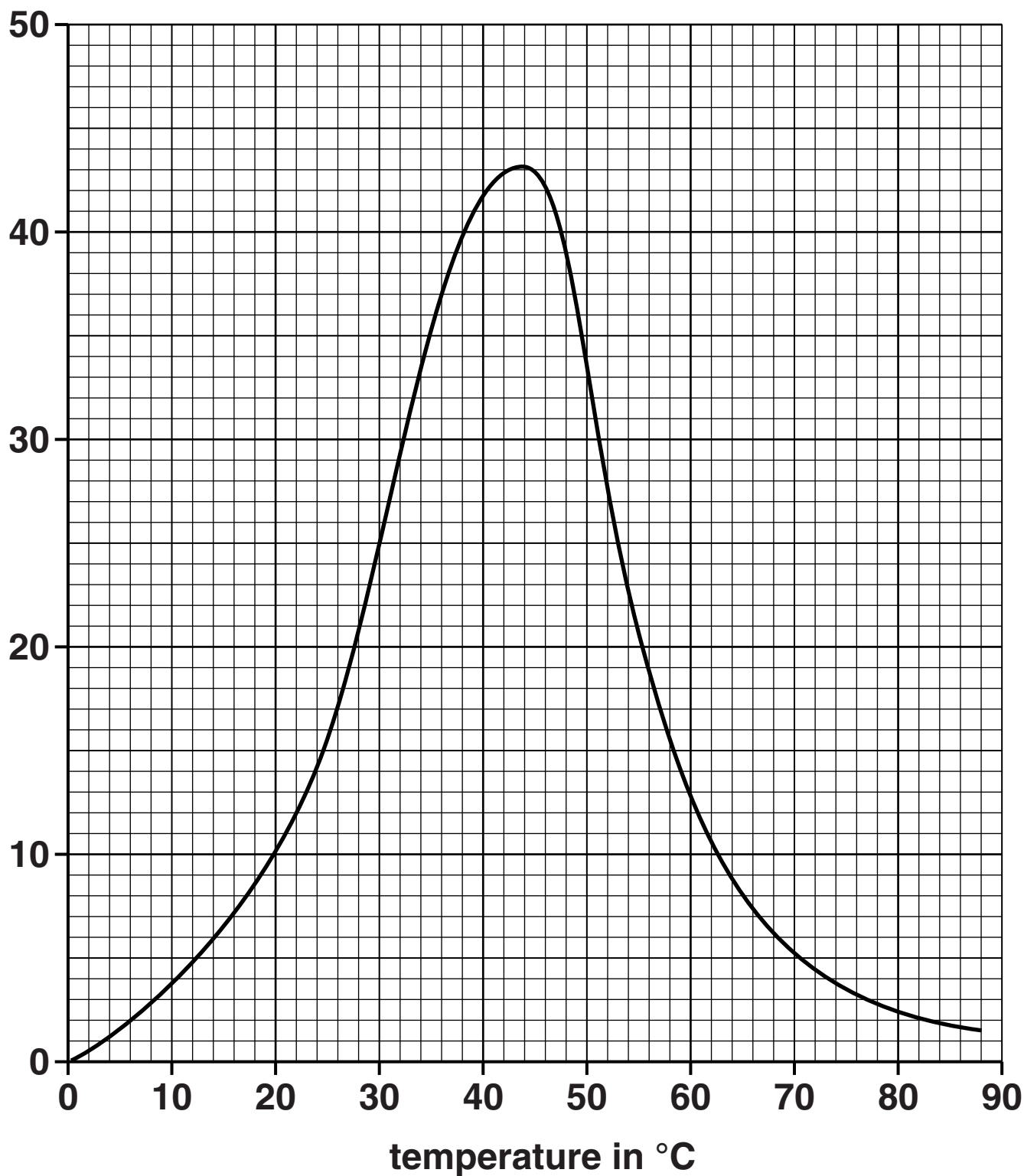


**Tina and Tommy measure the volume of carbon dioxide made after 10 minutes.**

**They do the experiment at different temperatures.**

**Look at the graph on page 30. It shows their results.**

**volume of carbon  
dioxide made after  
10 minutes in cm<sup>3</sup>**



(a) (i) What is the volume of carbon dioxide made at 70 °C?

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

(ii) At what temperature is the reaction fastest?

answer \_\_\_\_\_ °C

Explain your answer.

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

(b) Glucose reacts to make carbon dioxide and ethanol.

Look at the formulas.

Substance	Formula
glucose	C <sub>6</sub> H <sub>12</sub> O <sub>6</sub>
carbon dioxide	CO <sub>2</sub>
ethanol	C <sub>2</sub> H <sub>5</sub> OH

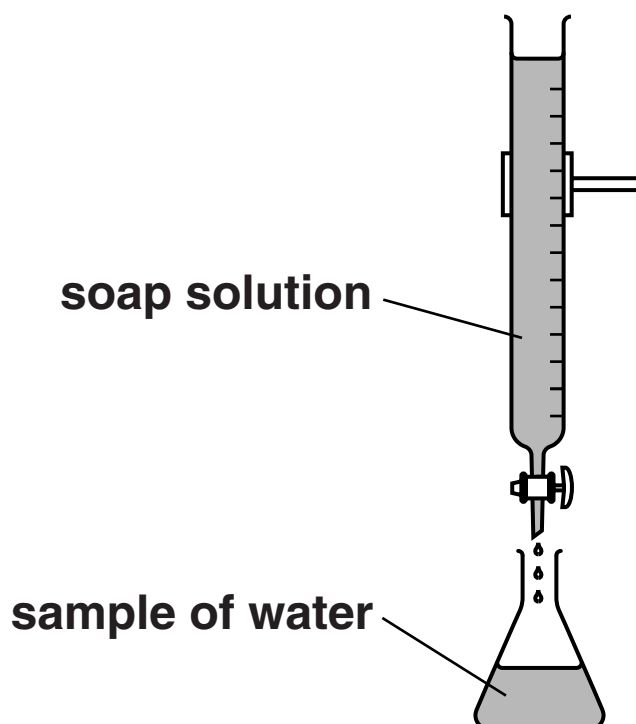
Write down the **BALANCED SYMBOL** equation for this reaction.

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

[TOTAL: 5]

**13 Sunita and Carl are investigating 3 samples of water, A, B and C.**

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



**They add soap solution to samples of water and shake them.**

**They keep adding more soap solution until a lather remains.**



Look at the table. It shows their results.

Sample		Volume of soap solution added in cm <sup>3</sup>
distilled water		2.0
sample A	before boiling	10.0
	after boiling	10.0
sample B	before boiling	12.0
	after boiling	6.0
sample C	before boiling	7.0
	after boiling	2.0

Place the water samples, A, B and C, in order of their hardness (hardest first).

Write about the different types of hardness in each of the samples A, B and C.

Explain your answers.



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

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[6]

[TOTAL: 6]

**14 This question is about the rusting of iron.**

**(a) Which TWO substances are needed for iron to rust?**

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

**(b) Write about TWO methods that can be used to stop iron from rusting.**

**Explain how ONE of the methods works.**

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

**[TOTAL: 5]**

**15 Joe wants to remove paint marks from his clothes.**

**Look at the table. It shows information about different solvents.**

<b>Solvent</b>	<b>Does it remove blue paint?</b>	<b>Does it remove red paint?</b>	<b>Does it remove yellow paint?</b>	<b>Does it damage the clothes?</b>
<b>A</b>	<b>yes</b>	<b>yes</b>	<b>no</b>	<b>no</b>
<b>B</b>	<b>no</b>	<b>no</b>	<b>yes</b>	<b>yes</b>
<b>C</b>	<b>no</b>	<b>yes</b>	<b>yes</b>	<b>yes</b>
<b>D</b>	<b>no</b>	<b>yes</b>	<b>yes</b>	<b>no</b>

**(a) Joe wants to remove blue and yellow paint from his clothes without damaging them.**

**Joe thinks he can use ONE OR MORE of these solvents to do this.**

**Is Joe right? \_\_\_\_\_**

**Explain your answer.**

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**[2]**

**(b) Joe wants to wash his clothes.**

**He looks at the label on the washing powder.**

**The label shows some of the ingredients in the washing powder.**

**Match each ingredient on the left, to its job, on the right.**

**Draw only three straight lines.**

**ingredient**

**job**

**active detergent**

**removes food stains**

**optical brightener**

**does the cleaning**

**enzymes**

**gives a whiter than white appearance**

**[2]**

**[TOTAL: 4]**

## SECTION D

**16 Water is a very important resource in the United Kingdom (UK).**

**(a) Look at the bar chart opposite.**

**It shows the uses of water in the UK for the years 2000, 2005 and 2010.**

**(i) What was the LARGEST use of water in the year 2000?**





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

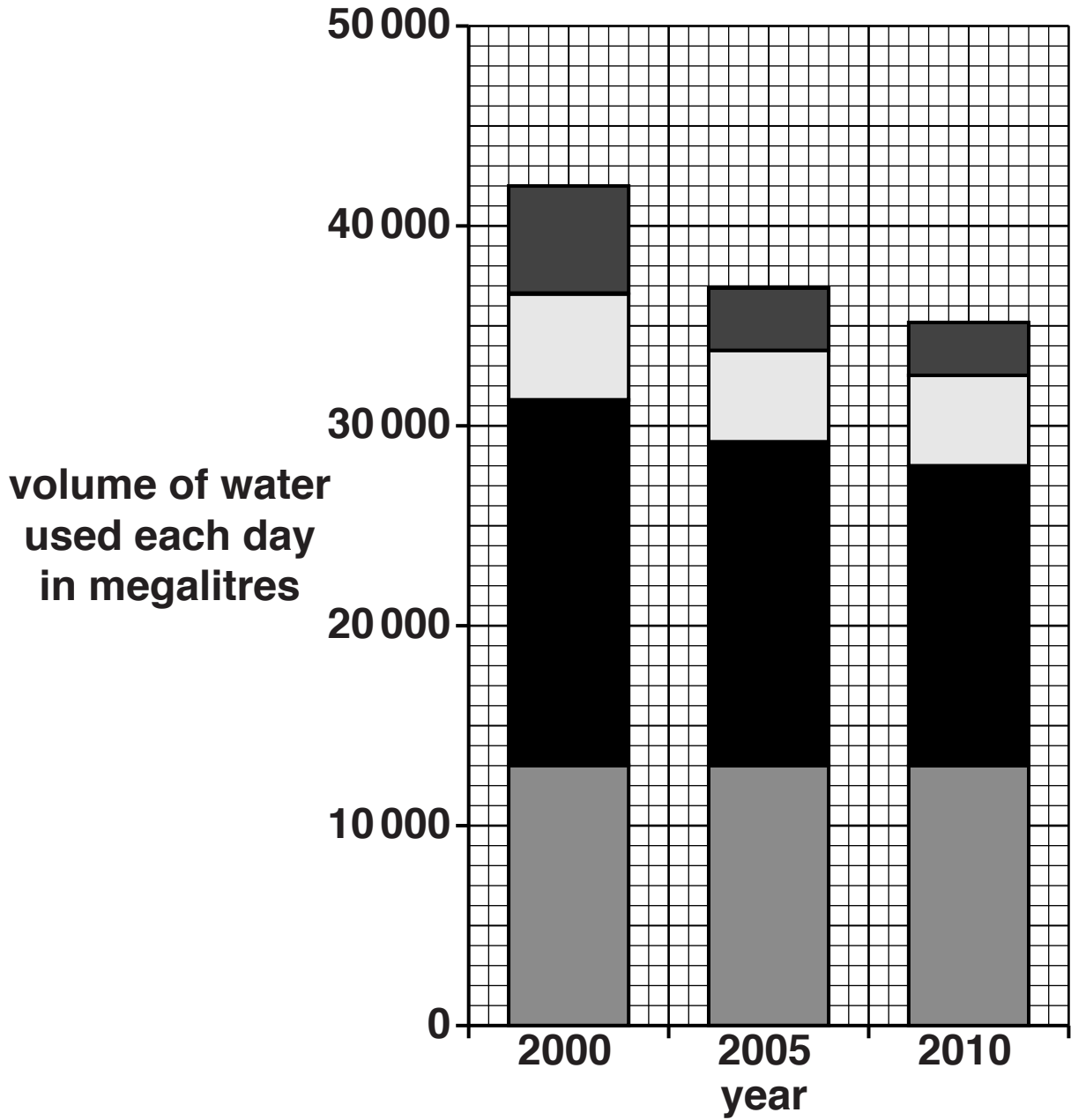
**(ii) The volume of water used for public water supply did not change between the years 2000 and 2010.**

**Describe THREE other patterns in water use between the years 2000 and 2010.**

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

**KEY**

-  public water supply
-  electricity generation
-  farming
-  other uses



**(iii) Look at the data for the year 2000.**

**In the year 2000 the volume of water used each day was 42 000 megalitres.**

**The volume of water used each day for PUBLIC WATER SUPPLY was 13 000 megalitres.**

**Show that the percentage of the water used for the public water supply was 30.95%.**

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**[2]**

**(iv) The VOLUME of water used for public water supply did not change between the years 2000 and 2010.**

**Describe how the PERCENTAGE of water used for the public water supply changed between the years 2000 and 2010.**

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**[1]**



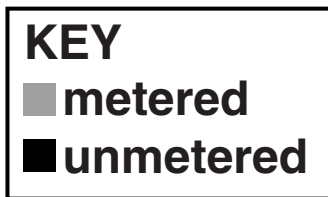
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**(b) The volume of water used for public water supply is affected by several factors.**

**Number of water meters fitted – people use much less water when they have a water meter fitted in their house**

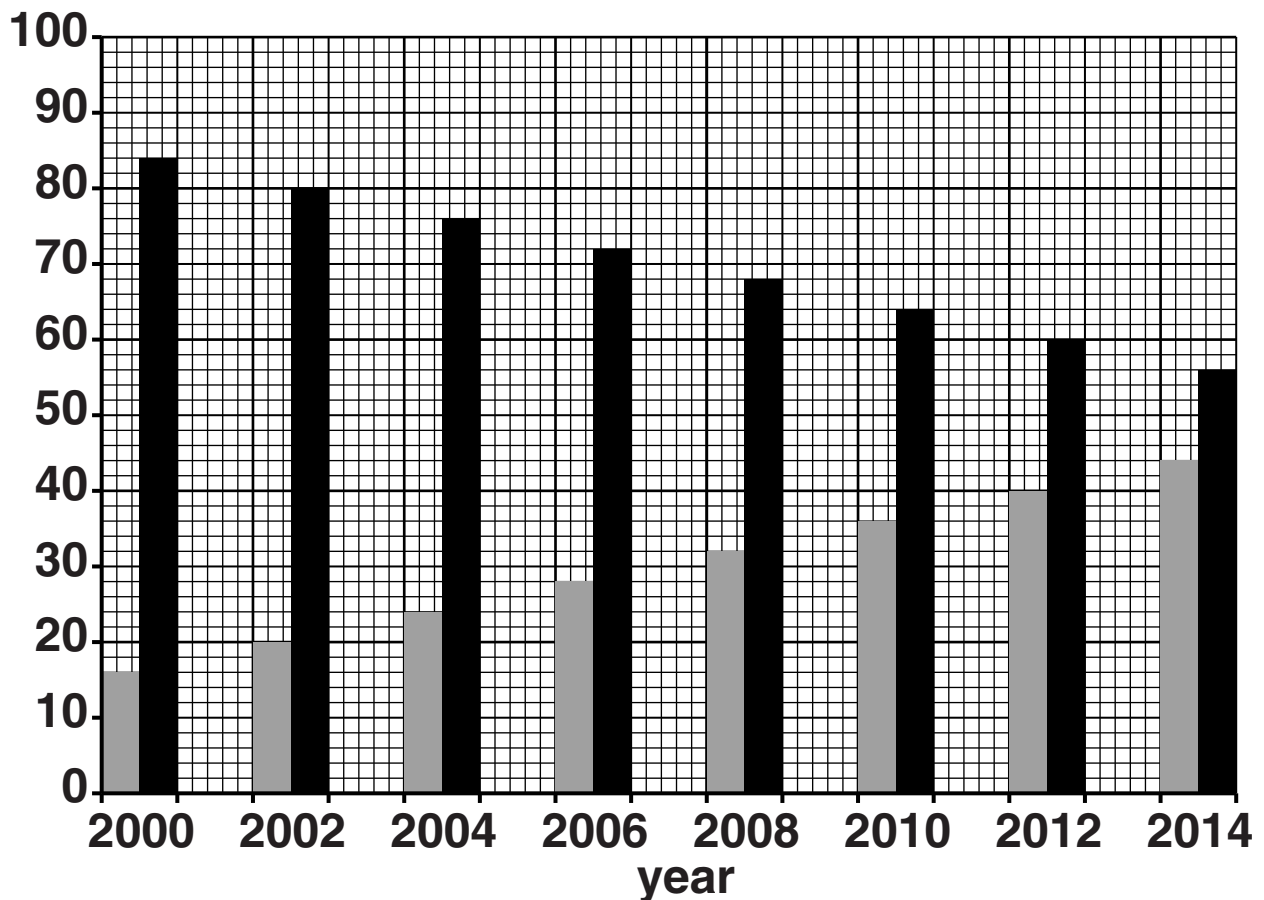
**Population**

**Look at the graphs about these two factors.**

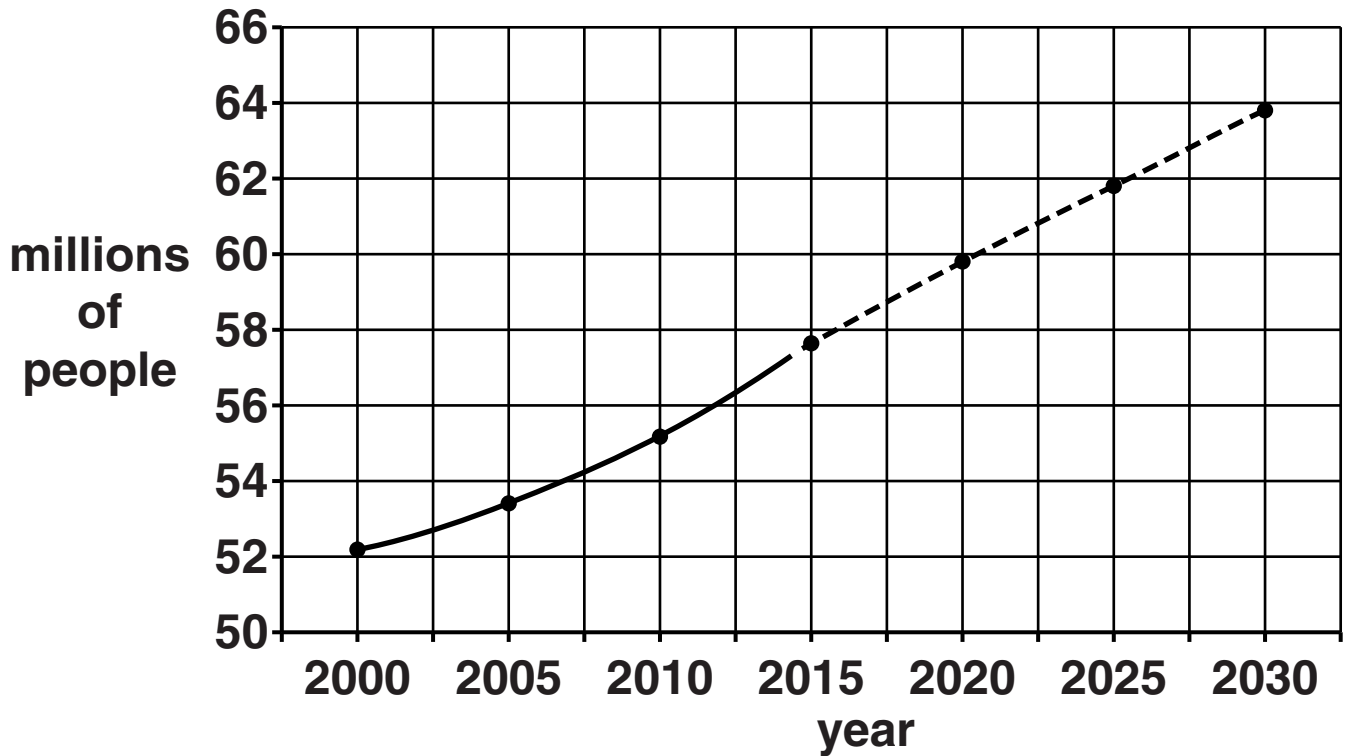


**percentage of households**

**Households with water meters in England and Wales 2000 to 2014**



## Population trends in England and Wales 2000 to 2030



Scientists predict that the volume of water needed for public water supply may not change much in the future.

Explain how the data in the graphs support this prediction.

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[3]

[TOTAL: 10]

END OF QUESTION PAPER



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