OCR

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Monday 16 June 2014 – Morning

GCSE GATEWAY SCIENCE
CHEMISTRY B

B742/01 Chemistry modules C4, C5, C6 (Foundation Tier)

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

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour 30 minutes

B 7 4 2 0 1

1275820600

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. 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).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- The Periodic Table can be found on the back page.
- 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**.
- This document consists of **28** pages. Any blank pages are indicated.

Answer **all** the questions.

SECTION A – Module C4

1 This question is about magnesium, Mg.

Use the Periodic Table on the back page 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. It shows information about the halogens.

Halogen	Formula	Colour	State at room temperature	Use
fluorine	F_2	pale yellow	gas	making sodium fluoride
chlorine	Cl_2	.....	gas	making plastics
bromine	Br_2	brown	.....	making medicines
iodine	I_2	grey	solid	....

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

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

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

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

[Total: 4]

3 Most metals have these physical properties.

shiny

high melting point

high boiling point

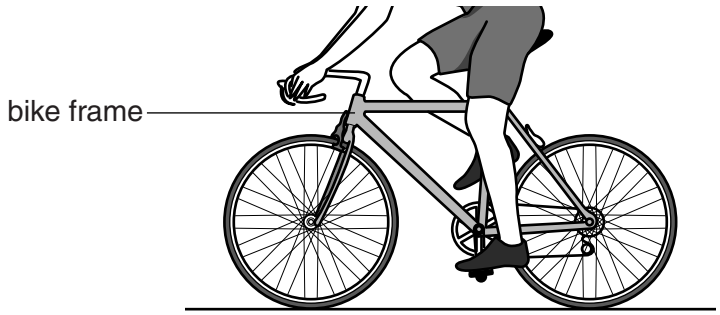
(a) Write down **two** other physical properties that most metals have.

.....

..... **[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]

4 An aluminium atom can be shown as

$$^{27}_{13}Al$$

(a) What do the numbers 27 and 13 mean?

Explain what the numbers tell you about the structure of an aluminium atom.

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

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..... **[6]**

(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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.....

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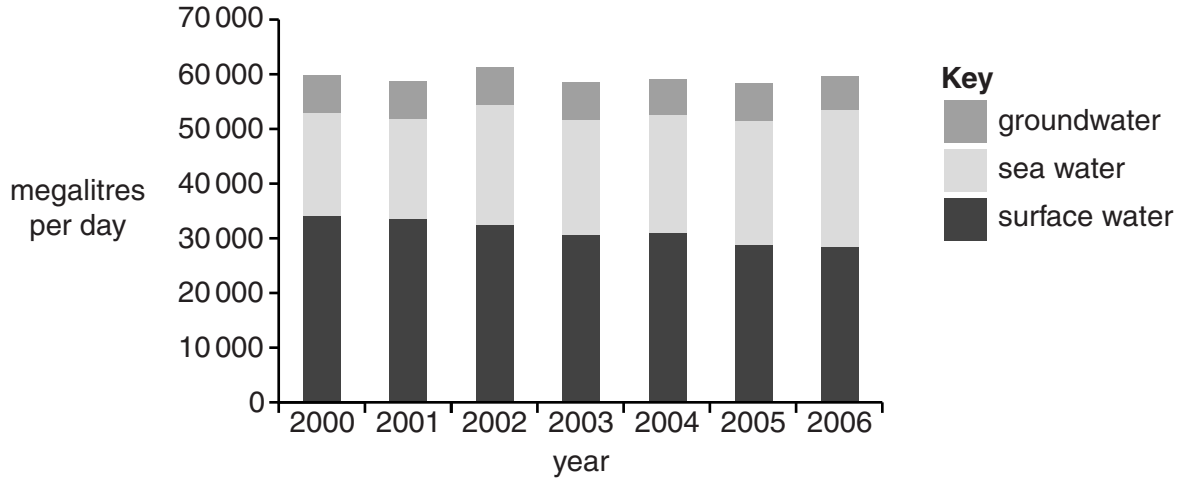
..... **[2]**

[Total: 8]

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.

.....

.....

..... **[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]

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Question 6 begins on page 8

PLEASE DO NOT WRITE ON THIS PAGE

SECTION B – Module C5

6 This question is about acids and alkalis.

(a) Indicators change colour in acids and alkalis.

Look at the table about some indicators.

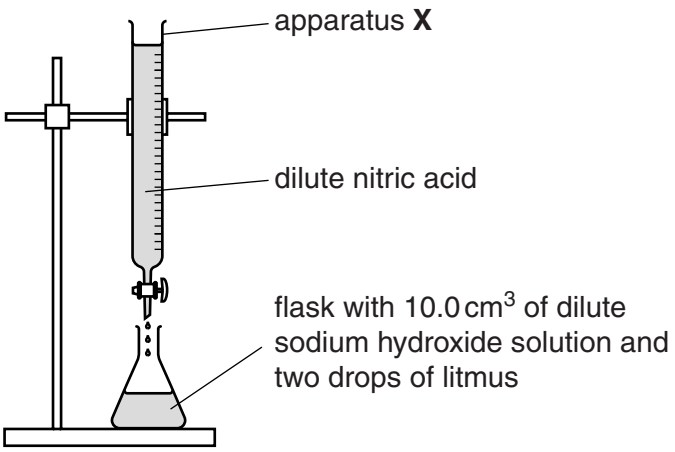
Indicator	Colour in		
	Acid	**Neutral**	**Alkali**
litmus	red	purple	blue
phenolphthalein	colourless	colourless	.....
universal indicator	red, orange or yellow	.....	blue or purple

Complete the table. **[2]**

(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 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.

.....

.....

..... **[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.

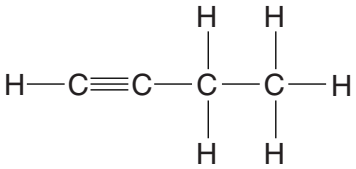
The relative atomic mass, A_r, of H = 1 and of C = 12.

.....

.....

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

CH_4	**C_2H_2**	**C_2H_4**
C_2H_6	**C_3H_4**	**C_6H_6**

answer ..... and ..... **[1]**

(d) David analyses a 1.6 g sample of methane, 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]**

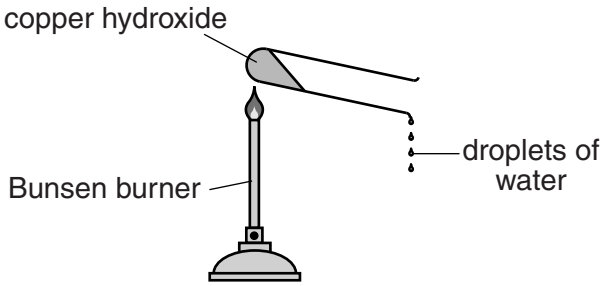
[Total: 4]

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.

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

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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..... **[3]**

[Total: 4]

9 Carbon dioxide, CO_2, reacts with hydrogen, H_2, to make methanol, CH_3OH.

$$CO_2 + 3H_2 \rightleftharpoons CH_3OH + H_2O$$

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.

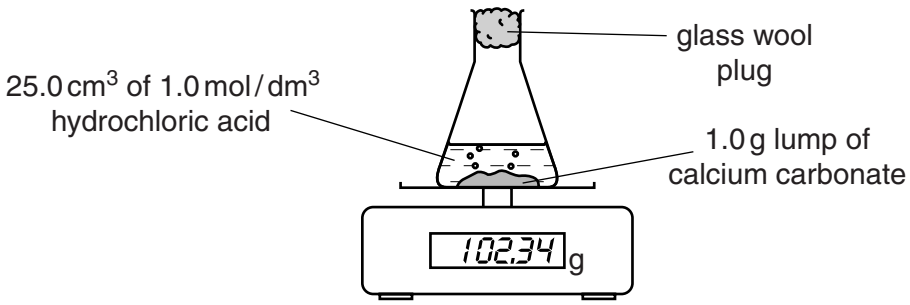
Hydrochloric acid reacts with calcium carbonate.

calcium carbonate + hydrochloric acid $\rightarrow$ calcium chloride + carbon dioxide + water

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

She adds 25.0 cm^3 of 1.0 mol / dm^3 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.

.....

.....

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

(b) Debbie repeats the experiment.

This time she uses 25.0 cm^3 of 1.0 mol / dm^3 **ethanoic acid** instead of hydrochloric acid.

Her results are different this time.

How are the results different?

Explain your answer.

.....

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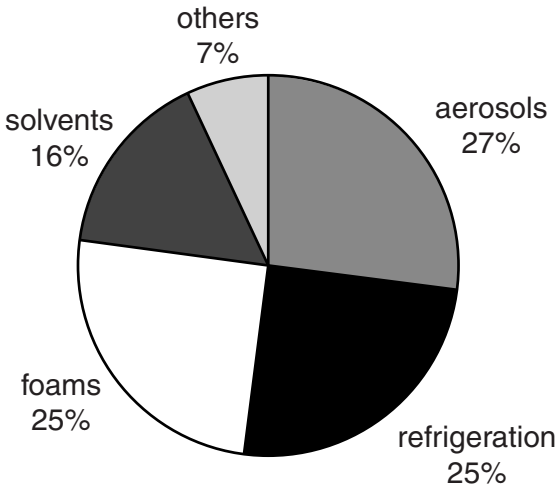
..... **[2]**

[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.

.....

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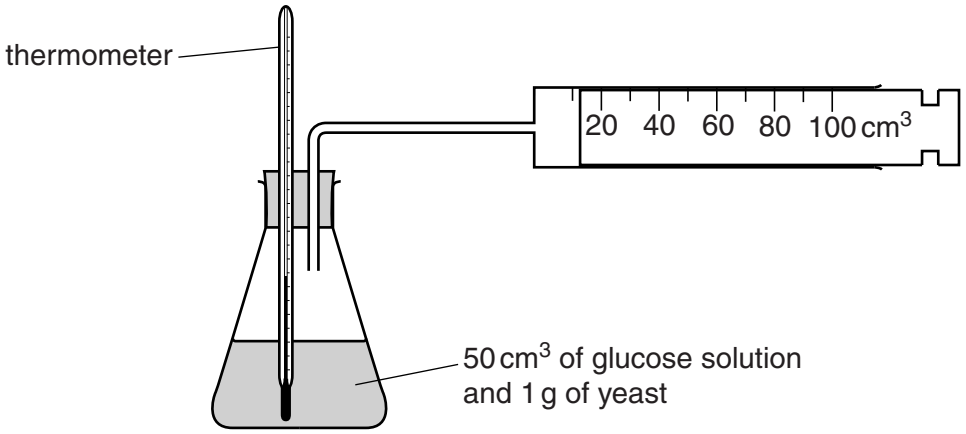
..... **[2]**

[Total: 5]

12 Ethanol can be made by the fermentation of glucose.

Tina and Tommy investigate the fermentation of glucose.

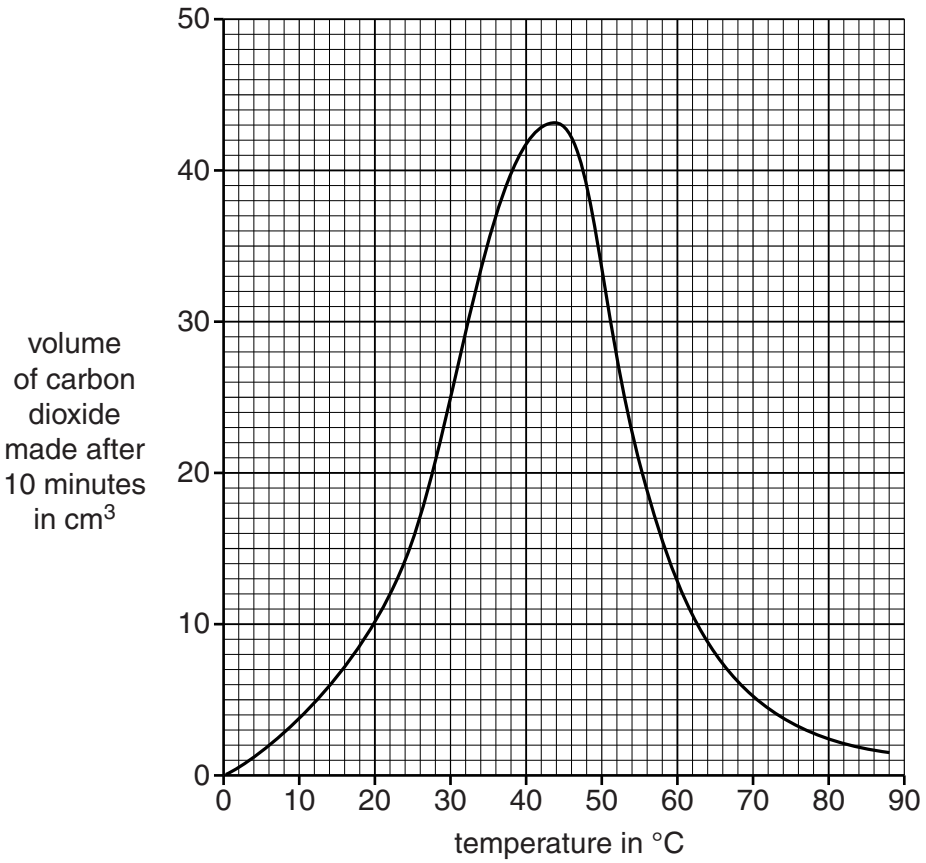
Look at the diagram. It shows the apparatus they use.



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

They do the experiment at different temperatures.

Look at the graph. It shows their results.



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

answer ..... cm^3 **[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	$C_6H_{12}O_6$
carbon dioxide	CO_2
ethanol	C_2H_5OH

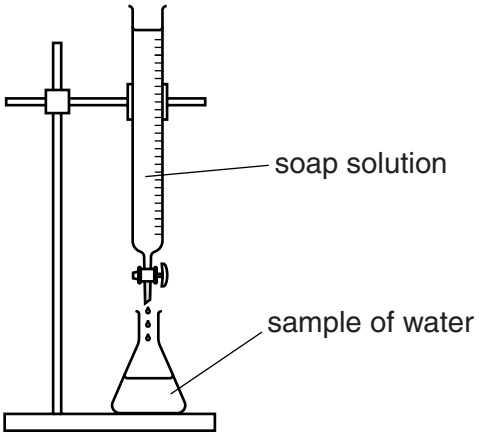
Write down the **balanced symbol** equation for this reaction.

..... **[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^3**
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.

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..... **[3]**

[Total: 5]

15 Joe wants to remove paint marks from his clothes.

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

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

(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 to its job.

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]

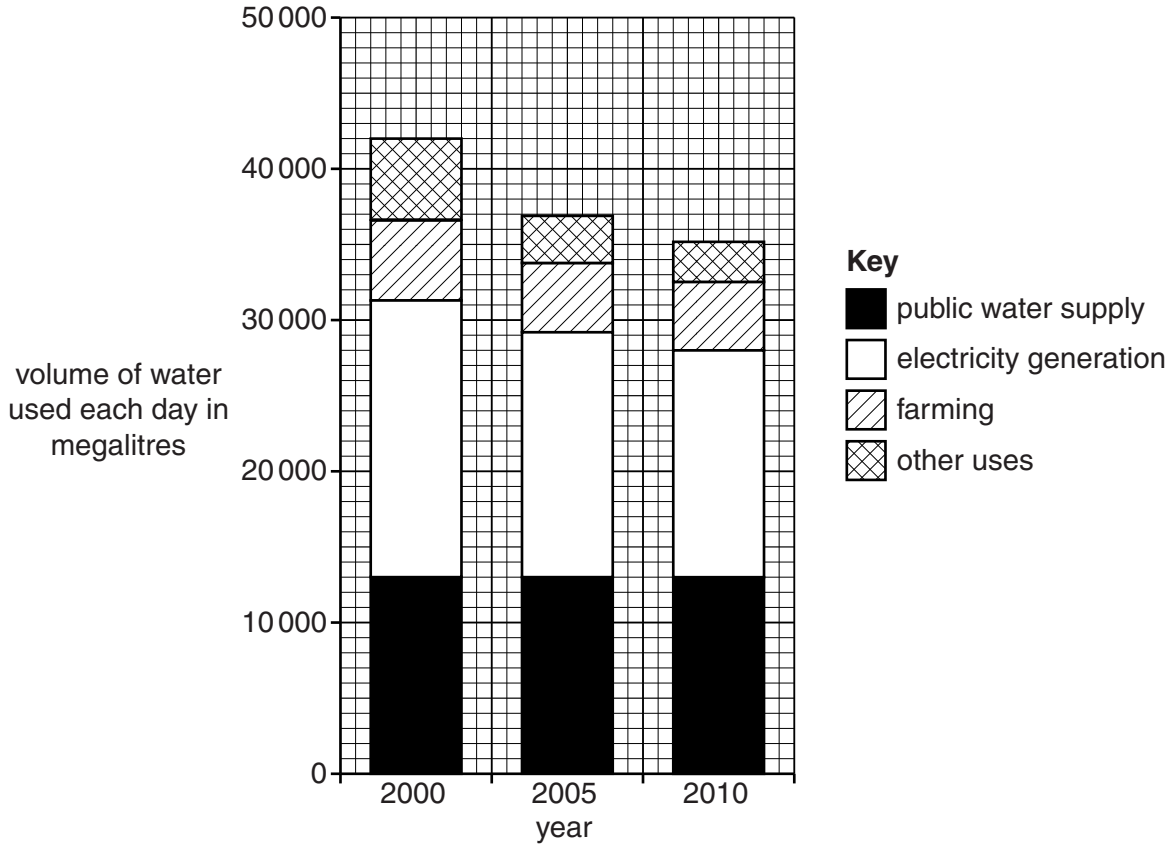
[Total: 4]

SECTION D

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

(a) Look at the bar chart.

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.

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..... **[3]**

(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.

.....

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

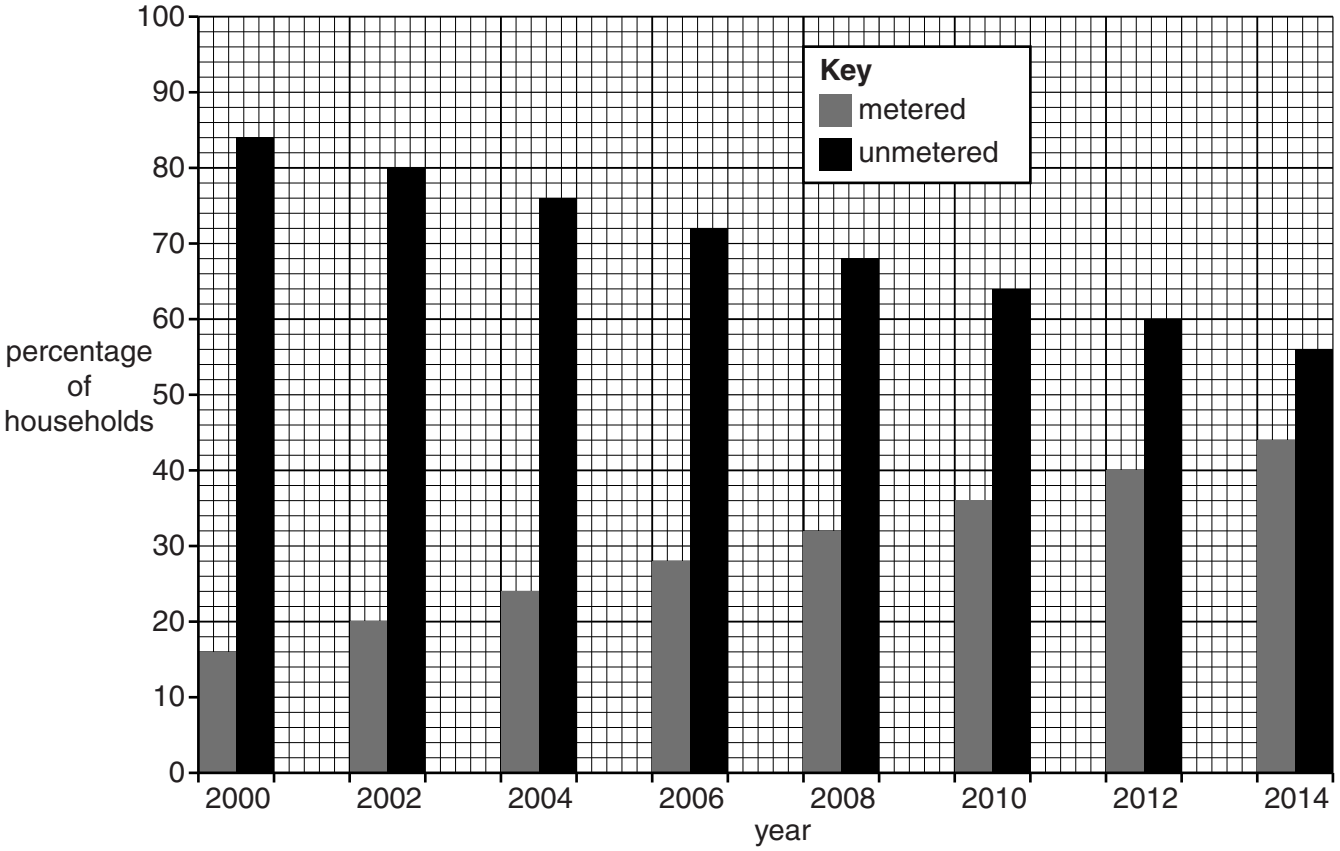
Question 16(b) begins on page 24

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

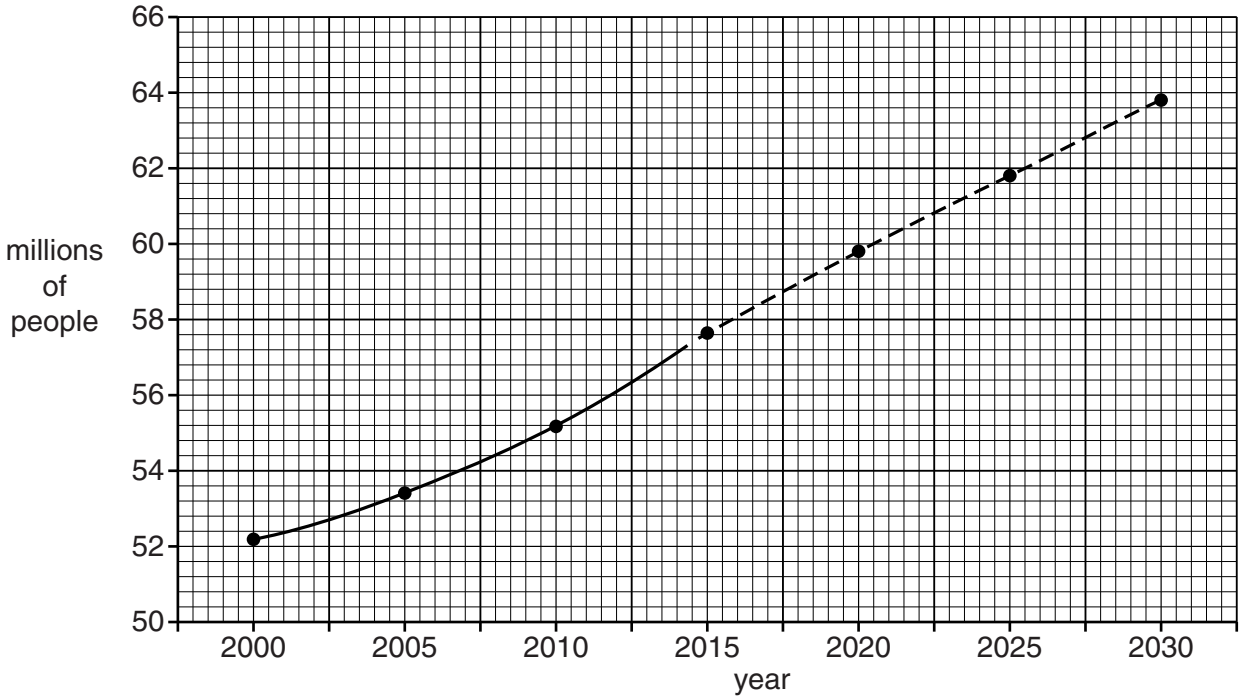
- Number of water meters fitted – people use much less water when they have a water meter fitted in their house
- Population

Look at the graphs about these two factors.

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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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.