Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4462/02

SCIENCE A/CHEMISTRY

CHEMISTRY 1
HIGHER TIER

A.M. TUESDAY, 14 January 2014

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**9**	
3.	**4**	
4.	**6**	
5.	**8**	
6.	**8**	
7.	**5**	
8.	**9**	
9.	**6**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
Do not use gel pen or correcting fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **4** and **9**.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

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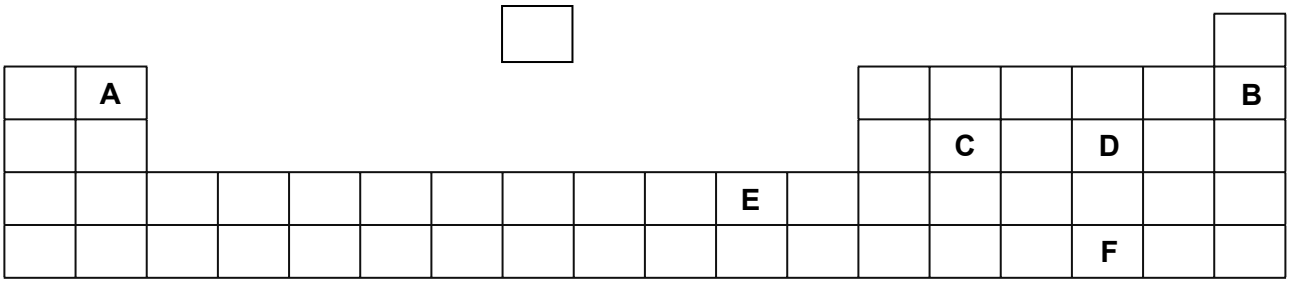
Answer **all** questions.

1. The following diagram shows an outline of the Periodic Table.
The letters shown are NOT the chemical symbols of the elements.



(a) Give the **letter** of the element which is found in Group 0 and Period 2. [1]

.....

(b) Give the **letters** of the **two** elements which you would expect to have similar chemical properties. Give a reason for your choice.

Letters ..... and .....

Reason ..... [2]

(c) The table below shows the properties of three elements **1**, **2** and **3**.

Element	Properties			
	Melting Point (°C)	Boiling Point (°C)	Appearance	Malleable or brittle
1	1084	2927	shiny brown solid	malleable
2	1414	2900	shiny grey solid	brittle
3	115	445	yellow solid	brittle

State, giving reasons, which of elements **1**, **2** or **3** could be element **C** in the Periodic Table above. [2]

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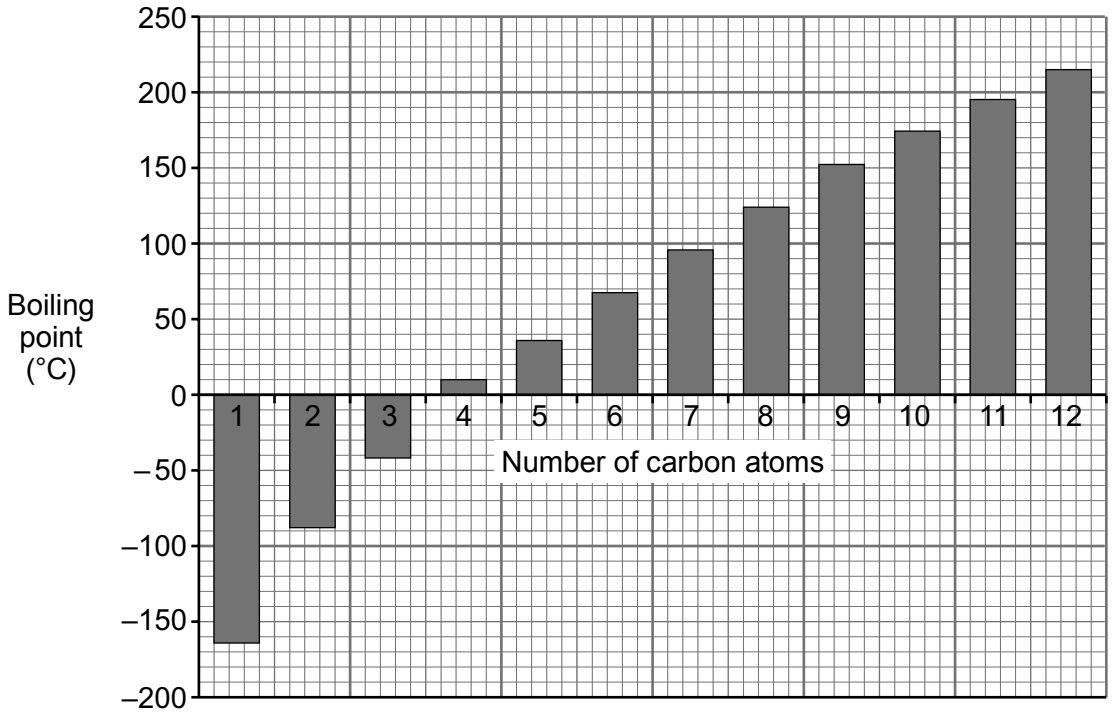
2. *(a)* Crude oil can be separated into simpler mixtures, called fractions, which contain hydrocarbon compounds with boiling points within a similar range.

The graph below shows the boiling points of hydrocarbons containing 1 to 12 carbon atoms.



(i) Give the number of carbon atoms in the hydrocarbon which has the **lowest** boiling point. [1]

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(ii) State how the boiling point changes as the number of carbon atoms increases. [1]

.....

(iii) A company wants to produce a fraction with a boiling point in the range 120–140 °C.
Give the number of carbon atoms present in the hydrocarbons found in this fraction. [1]

.....

(b) Plastic has replaced glass for making some drink bottles.
Apart from cost, give **one** property of plastic that makes it a more suitable material for making drink bottles. [1]

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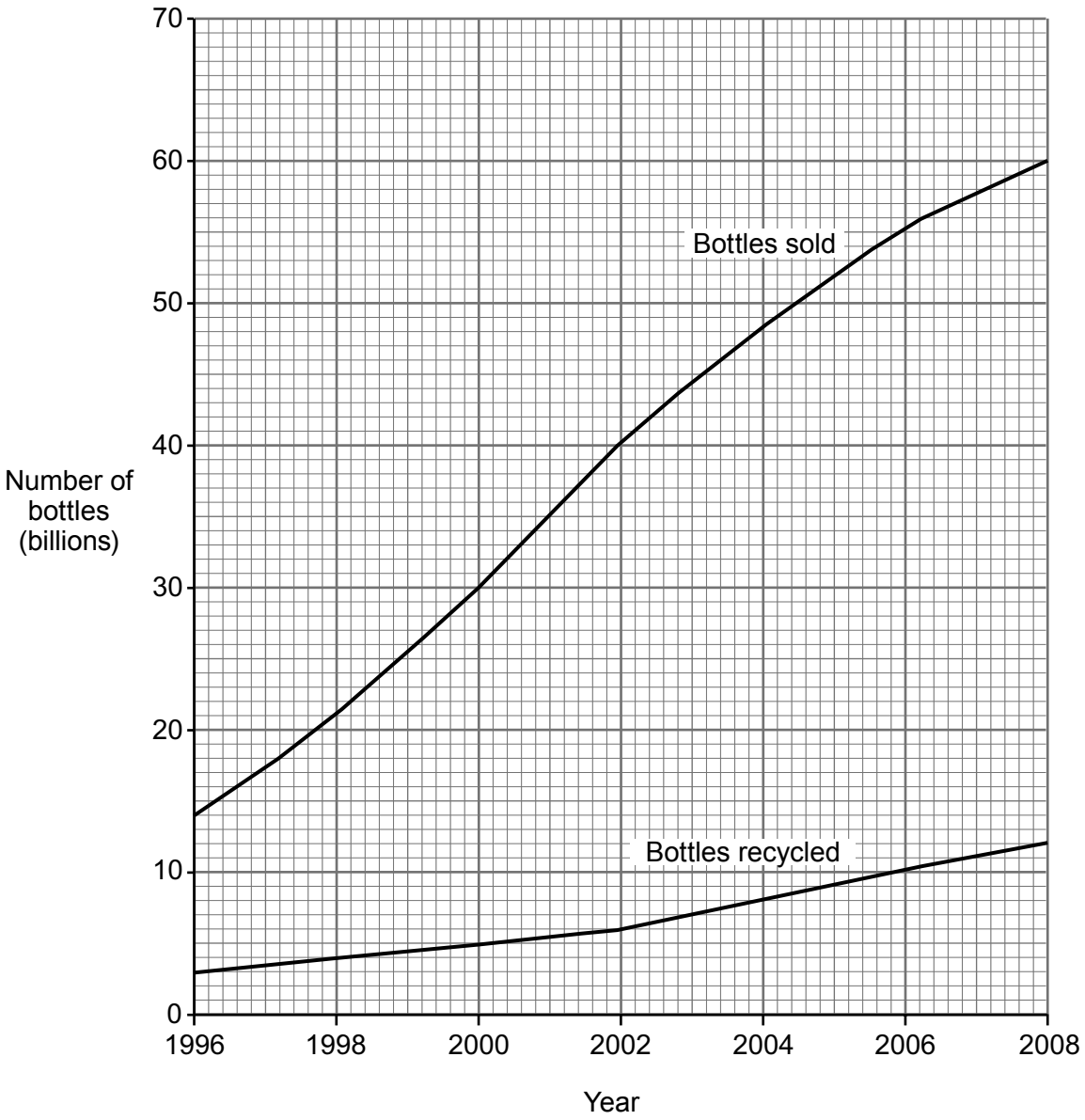
(c) The graph below shows the number of plastic drink bottles sold and recycled in the United States between 1996 and 2008.



Calculate the percentage (%) of plastic bottles sold in 2008 that were recycled. [2]

Percentage recycled = ... %

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(d) State and explain the advantages of recycling plastic. [3]

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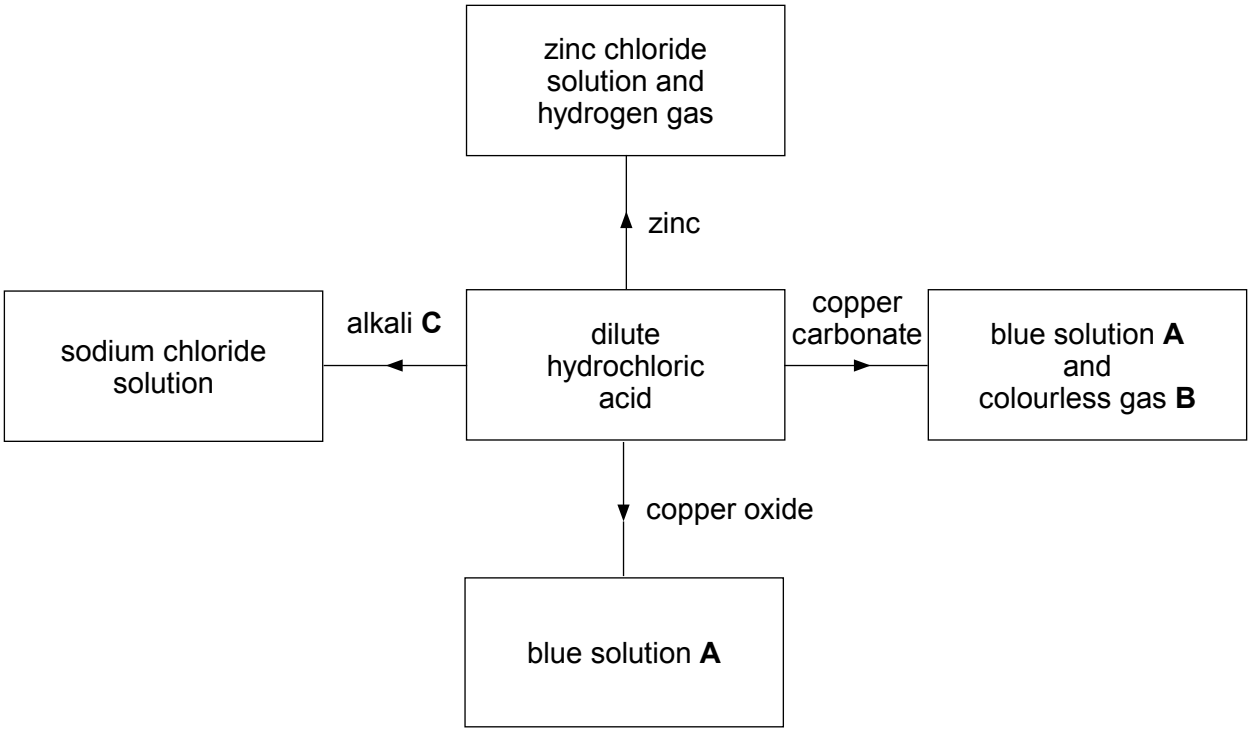
3. The diagram below shows some reactions of dilute hydrochloric acid.



(a) Name the following substances.

blue solution **A** .....

colourless gas **B** .....

alkali **C** ..... [3]

(b) Balance the **symbol** equation for the reaction between zinc and dilute hydrochloric acid. [1]

$$Zn + \square HCl \longrightarrow ZnCl_2 + H_2$$

4

Turn over.

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4. All water supplies in the UK are chlorinated but only some are fluoridated.

State why each process is carried out and outline why some people are opposed to the fluoridation of drinking water but no one opposes chlorination. [6 QWC]

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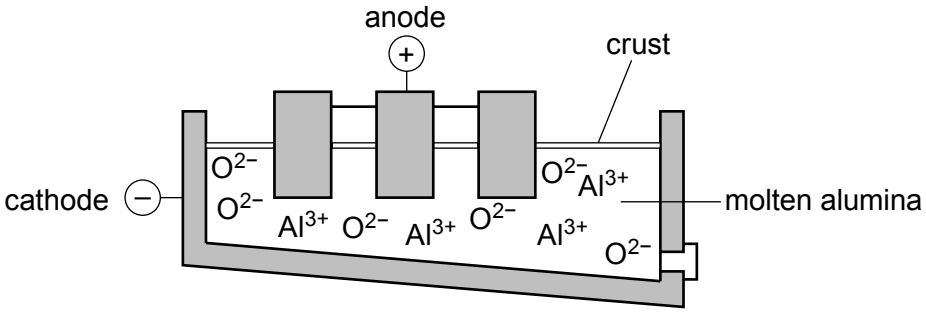
5. *(a)* Aluminium is obtained by the electrolysis of molten alumina.



The electrode equations below show how the products are formed.

$$Al^{3+} + 3e \longrightarrow Al$$

$$2O^{2-} - 4e \longrightarrow O_2$$

(i) Choose from the equations above

an ion, ...

an atom, ...

a molecule. ..... [2]

(ii) At which electrode is aluminium formed? Give the reason for your answer. [2]

.....

.....

(iii) Use the information in the diagram above to give the chemical name and formula of alumina. [2]

Chemical name .....

Formula .....

(iv) State **one** environmental problem associated with the **electrolysis** of molten alumina. [1]

.....

(b) Aluminium is a good electrical conductor and is therefore used to make overhead power cables.

Give a **different** property of aluminium and **one** use which relies on this property. [1]

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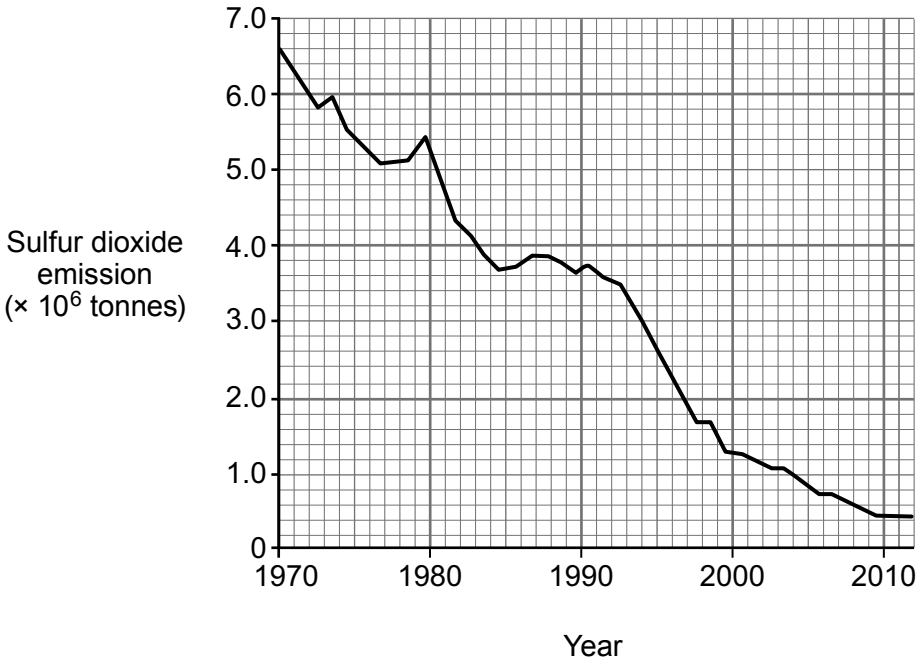
6. *(a)* The graph below shows the total sulfur dioxide emissions in the UK between 1970 and 2012.



(i) Use the graph to calculate the decrease in sulfur dioxide emissions in **tonnes** between 1994 and 2004. [1]

Decrease in sulfur dioxide emissions = ... tonnes

(ii) Suggest and explain a possible reason for the trend shown in the graph. [2]

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(iii) Balance the symbol equation below which shows a reaction that can lead to the formation of sulfuric acid in the atmosphere. [1]

$$\square\ SO_2 + \square\ H_2O + O_2 \longrightarrow \square\ H_2SO_4$$

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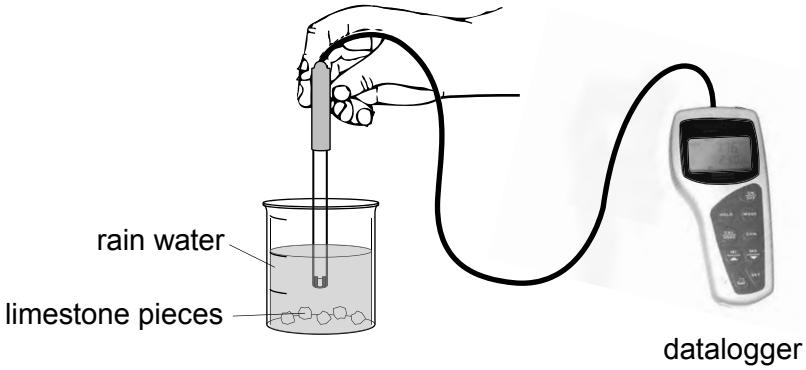
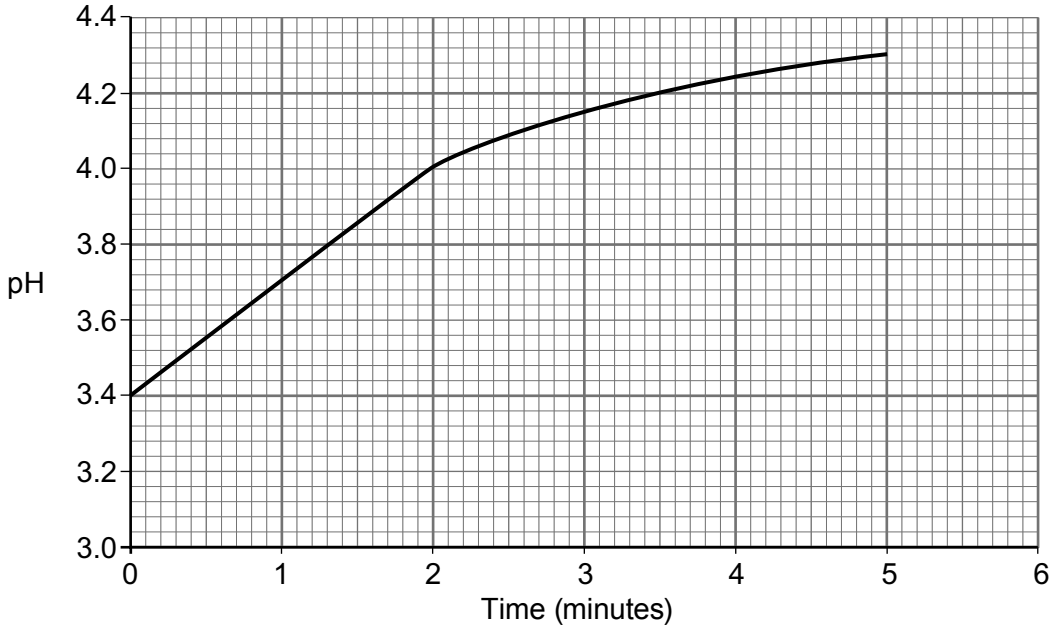
(b) A group of pupils investigated the pH change which occurs when limestone reacts with acid rain. The group collected rain water during a rain shower.

They used the apparatus shown below.



They added limestone pieces to the rain water and recorded the pH of the mixture for 5 minutes. The data collected was then downloaded to a computer.

The graph below shows the results recorded.



(i) Name the type of reaction taking place. [1]

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(ii) Limestone affects the acidity of acid rain. Describe how the graph supports this statement. [2]

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.....

(iii) Apart from destroying limestone buildings and statues, give **one** *other* problem associated with acid rain. [1]

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7. Satellite images are used to show the area of Arctic sea ice.

Photograph: National Snow and Ice Data Centre, Colorado.

(a) The shrinking of the ice cap is interpreted by environmental groups as the result of global warming. State and explain the **main** cause of global warming. [2]

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(b) Give **one** consequence of the reduction of Arctic sea ice. [1]

.....

(c) Scientists are currently developing a process called ***carbon capture and storage (CCS)*** to reduce the problem of global warming. There are three main steps to CCS. Firstly, carbon dioxide is trapped and separated from other gases produced in coal-powered electricity plants. The captured carbon dioxide is transported to a storage location and finally stored far away from the atmosphere (underground or deep in the ocean).

Use this information to suggest **two** reasons why some scientists do not support the use of CCS. [2]

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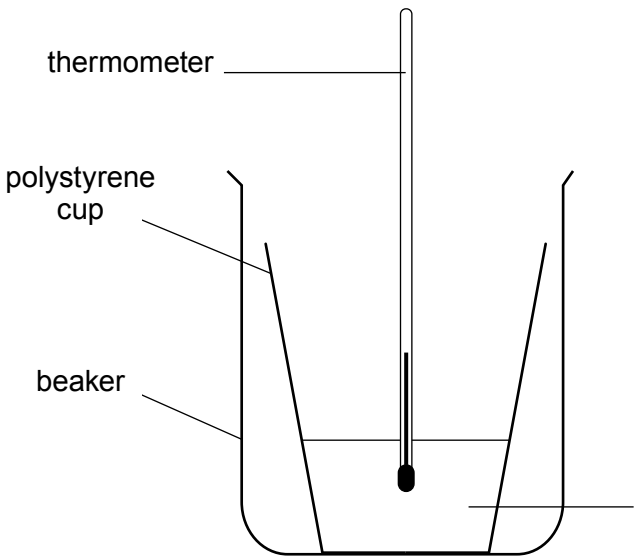
8. A pupil used the apparatus below to carry out an investigation to find the temperature change which occurs when dilute hydrochloric acid reacts with dilute sodium hydroxide solution.



The pupil measured 50 cm^3 of sodium hydroxide solution, using a measuring cylinder, into a polystyrene cup. He then added 80 cm^3 of acid, 10 cm^3 at a time, and recorded the highest temperature each time. The experiment was repeated.

Volume of acid added (cm^3)	Temperature (°C)		
	Experiment 1	Experiment 2	Mean
0	21.0	21.0	21.0
10	22.1	23.5	22.8
20	24.9	23.5	24.2
30	28.0	22.8	25.4
40	26.0	26.8	26.4
50	27.4	26.6	27.0
60	26.6	26.8	26.7
70	26.2	26.2	26.2
80	25.5	25.7	25.6

(a) From the data in the **table**, state the volume of acid where the temperature readings appear to be incorrect. Give the reason for your choice. [2]

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(b) On the grid opposite plot the volume of acid against the **mean** temperature and draw a suitable line. [3]

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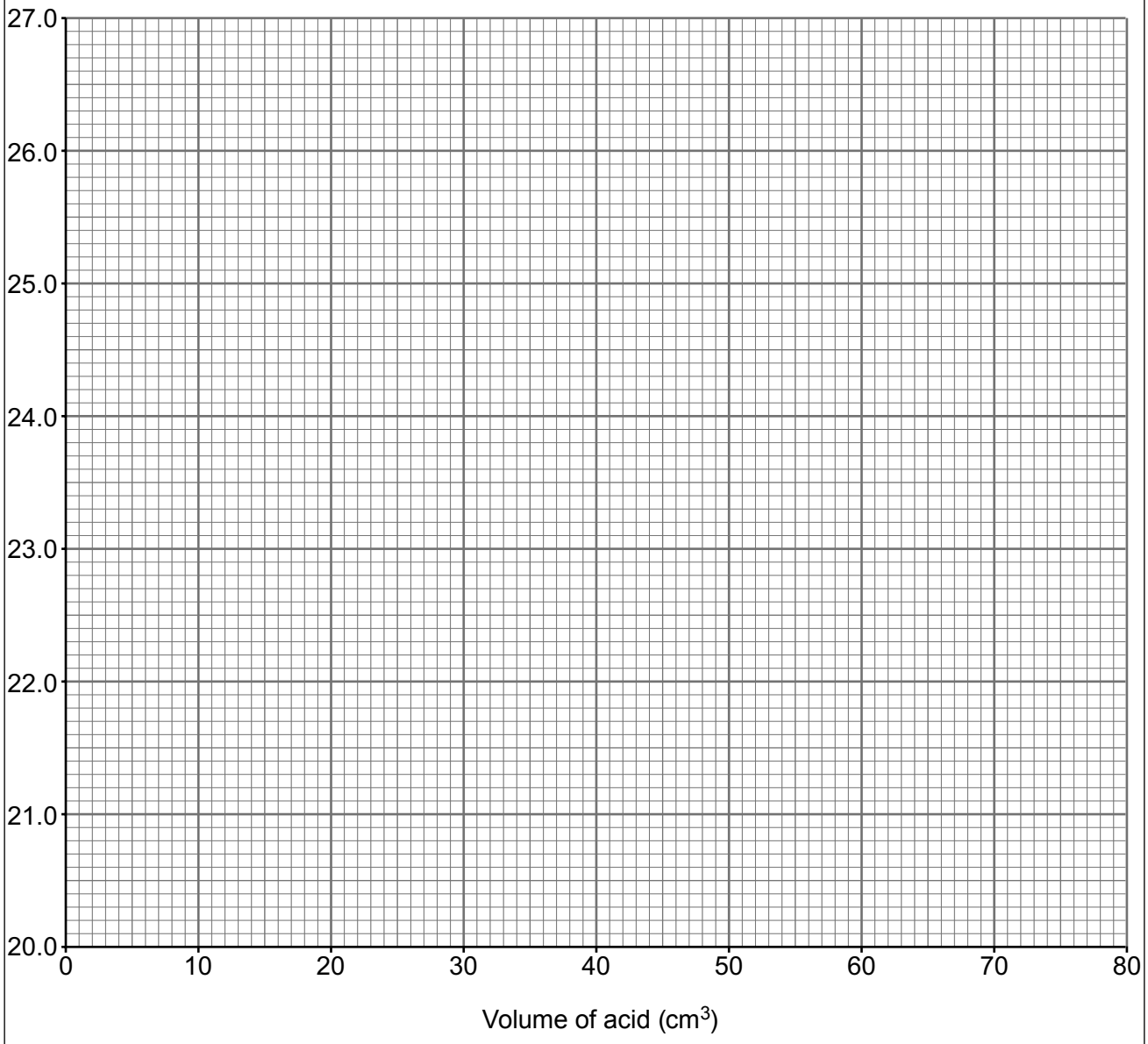

(c) Using your graph, state why the incorrect temperature readings identified in part *(a)* might not have been noticed by the pupil. [1]

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(d) Describe and explain the shape of the graph in relation to the chemical reaction taking place. [3]

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Turn over.

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9. Many car companies are manufacturing hydrogen-fuelled cars.
Describe and explain the advantages and disadvantages of hydrogen as a replacement for petrol and diesel to fuel cars. [6 *QWC*]

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}$H Hydrogen									$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulfur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key: