Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature								

General Certificate of Secondary Education
March 2008

SCIENCE A **CHY1AP**
Unit Chemistry C1a (Products from Rocks)

CHEMISTRY
Unit Chemistry C1a (Products from Rocks)

Wednesday 5 March 2008 Morning Session

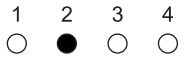
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

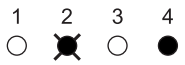
Time allowed: 30 minutes

Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Chemistry Unit 1a' printed on it.
- Attempt **one Tier only, either** the Foundation Tier **or** the Higher Tier.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only.
- Do all rough work in this book, **not** on your answer sheet.

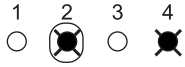
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- Do **not** extend beyond the circles.
- If you want to change your answer, **you must** cross out your original answer, as shown:



- If you change your mind about an answer you have crossed out and now want to choose it, draw a ring around the cross as shown:



Information
- The maximum mark for this paper is 36.

Advice
- Do **not** choose more responses than you are asked to. You will lose marks if you do.
- Make sure that you hand in both your answer sheet and this question paper at the end of the test.
- If you start to answer on the wrong side of the answer sheet by mistake, make sure that you cross out **completely** the work that is not to be marked.

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 14 of this booklet.

FOUNDATION TIER

SECTION ONE

Questions **ONE** to **SIX**.

In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

This question is about substances that are released into the air when fuels burn.

Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A sulfur dioxide

B carbon dioxide

C carbon monoxide

D particles

	What we can say about the substance
1	It is a cause of global warming.
2	It is the main cause of acid rain.
3	It is a gas formed by incomplete combustion.
4	It is a cause of global dimming.

QUESTION TWO

The word equation shows how tin can be extracted from tin oxide.

$$\text{tin oxide} + \text{carbon} \xrightarrow{\text{heat}} \text{tin} + \text{carbon dioxide}$$

Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A carbon

B carbon dioxide

C tin

D tin oxide

In the reaction above, . . .

the compound obtained from the ore is . . . **1** . . . .

the substance released as a waste gas is . . . **2** . . . .

the element that causes reduction is . . . **3** . . . .

the element produced by this reaction is . . . **4** . . . .

Turn over for the next question

QUESTION THREE

This question is about formulae of chemical compounds.

Match statements, **A**, **B**, **C** and **D**, with the formulae **1–4** in the table.

A this compound contains hydrogen

B this compound is a carbonate

C this formula has only two atoms

D this formula has only two oxygen atoms

	Formula
1	$CaCO_3$
2	CaO
3	CO_2
4	H_2O

QUESTION FOUR

This question is about crude oil.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A condensed

B heated

C separated

D vaporised

Crude oil can be . . . **1** . . . into a number of different fractions.

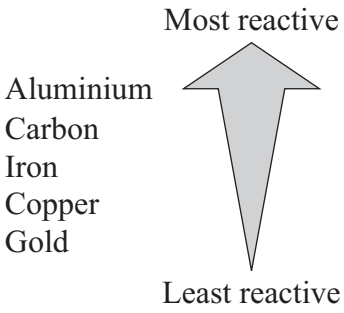
The crude oil is first . . . **2** . . . .

This causes the hydrocarbons in the crude oil to be . . . **3** . . . .

The vapours cool and are then . . . **4** . . . at different temperatures.

QUESTION FIVE

This is the order of reactivity for five elements.



Match metals, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A iron

B aluminium

C copper

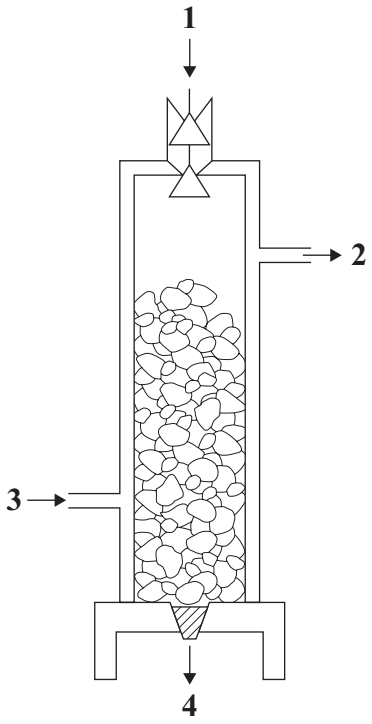
D gold

	What we can say about the metal
1	It will **not** react with oxygen or water even at high temperatures.
2	It is made in the blast furnace by the reduction of its oxide with carbon.
3	It can be extracted from its molten ore with electricity but **not** with carbon.
4	It can be extracted from its ore with carbon and is purified by electrolysis.

Turn over for the next question

QUESTION SIX

The diagram shows how limestone can be heated in a lime kiln to produce quicklime.



Match substances, **A**, **B**, **C** and **D**, with the labels **1–4** on the diagram.

A carbon dioxide

B hot air

C limestone

D quicklime

Turn over for the next question

SECTION TWO

Questions **SEVEN** to **NINE**.

Each of these questions has four parts.

In each part choose only **one** answer.

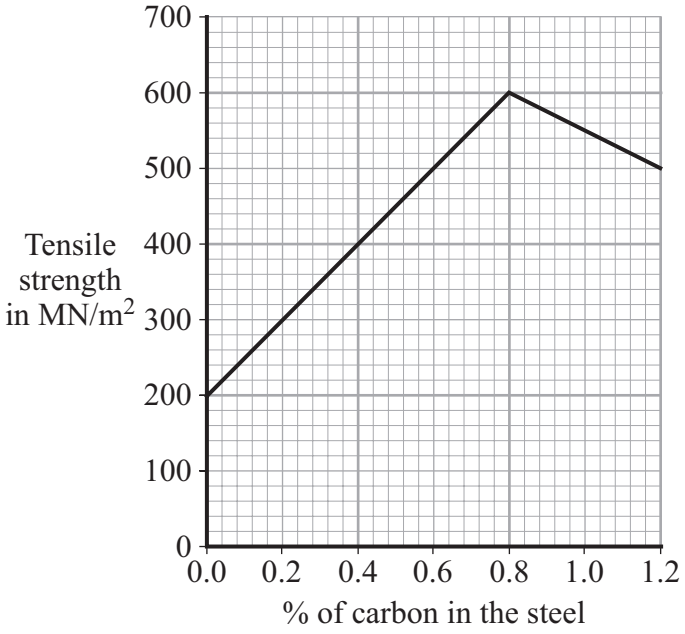
Mark your choices on the answer sheet.

QUESTION SEVEN

Materials with a high tensile strength do **not** break easily when pulled.

To measure the tensile strength of steel, a sample is pulled with a larger and larger force until it breaks.

The graph shows how the tensile strength of different steels depends on the percentage (%) of carbon the steels contain.



7A One type of steel has a tensile strength of 400 MN/m^2.

How much carbon does it contain?

1 0.3%

2 0.4%

3 0.5%

4 4.0%

7B The steel with the highest tensile strength is one with . . .

1 0.6% carbon.

2 0.8% carbon.

3 1.2% carbon.

4 8.0% carbon.

7C From the evidence on the graph, what is the best way to describe how carbon affects the tensile strength of steel?

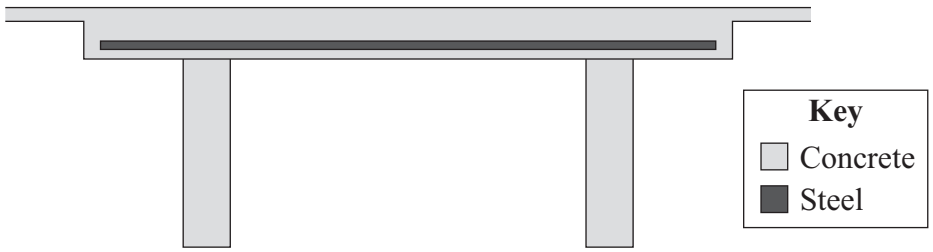
1 As the carbon content decreases, the tensile strength increases.

2 As the carbon content increases, the tensile strength decreases.

3 As the carbon content increases, the tensile strength increases then decreases.

4 The tensile strength increases when the carbon content is greater than 0.8%.

7D The diagram shows one type of bridge design.



The tensile strength of concrete is very low compared with the tensile strength of steel.

Some other comparisons of concrete and steel are shown below.

	Compressive strength (MN/m^2)	**Density (kg/m^3)**	**Cost**
Concrete	30	2300	Low
Steel	250	7700	Medium

Two reasons why the bridge is **not** made only of steel are that . . .

1 steel has a high density and is expensive.

2 steel has a high compressive strength and a high density.

3 steel has a high tensile strength and a high compressive strength.

4 steel has a high tensile strength and a high density.

QUESTION EIGHT

Four students each did three experiments to see how much quicklime they could get by heating 5.00 g of limestone. They heated the three separate samples of limestone until the mass of each sample no longer decreased.

The results are shown below.

	Mass of quicklime obtained from 5.00 g of limestone in g		
Student	**Experiment 1**	**Experiment 2**	**Experiment 3**
W	2.80	2.82	2.78
X	2.83	2.83	2.84
Y	2.84	2.84	3.46
Z	2.78	2.76	2.73

The maximum amount of quicklime that you can get from 5.00 g of limestone is 2.80 g.

8A How can the students check the reliability of their results?

1 Use a higher temperature to heat the limestone.

2 Ask another group of students to carry out the same experiment.

3 Use 10.00 g samples of limestone.

4 Heat each sample of limestone for longer.

8B Which student produced the most accurate mean result?

1 **W**

2 **X**

3 **Y**

4 **Z**

8C What is the best mean value of student **Y**'s results?

1 2.84 g

2 3.04 g

3 3.15 g

4 9.12 g

Limestone is in demand and is quarried on a vast scale, often in areas of natural beauty. The limestone is quarried using explosives.

8D Which one of the following is true about quarrying limestone?

1 Visual pollution can be reduced by turning the quarry, after use, into a lake for recreational use by the public.

2 Noise pollution can be reduced by carrying out the explosions at night.

3 Environmental pollution is reduced because more jobs will be created in the area.

4 The blasting itself does **not** cause air pollution.

Turn over for the next question

QUESTION NINE

Scientists have been concerned for some time about the effects of releasing large amounts of sulfur dioxide into the atmosphere. Much of the sulfur dioxide is formed from burning fuels that contain sulfur. The equation for this reaction is:

$$S + O_2 \rightarrow SO_2$$

9A The equation given above for the burning of sulfur is balanced because . . .

1 there are the same number of atoms on each side of the equation.

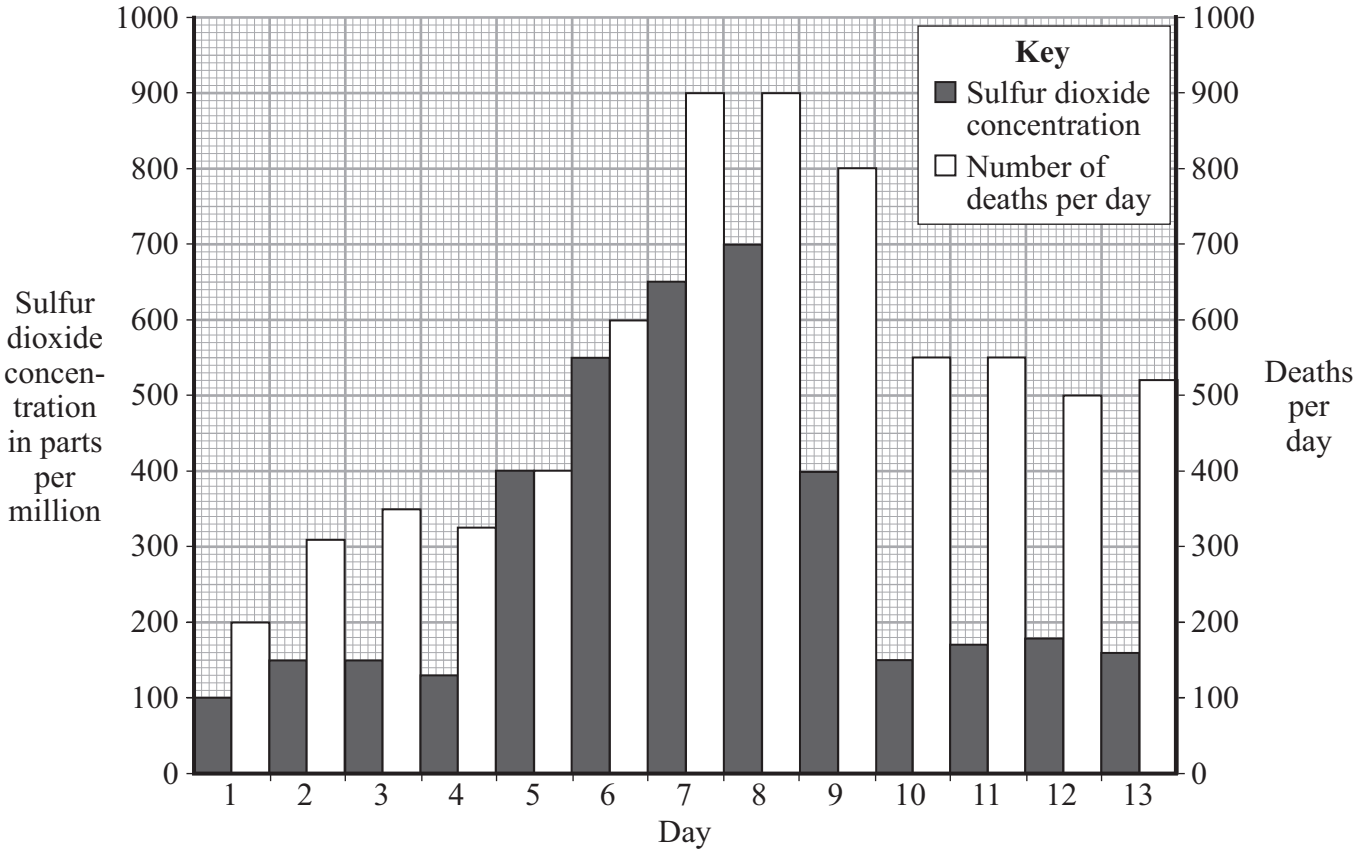
2 there are the same number of each type of atom on each side of the equation.

3 the amount of sulfur dioxide in the air stays about the same.

4 only two elements are involved in the equation.

Some scientists believe that sulfur dioxide is responsible for human deaths. To support this idea, they looked at the death rates during the smogs that occurred in London in the 1950s. The smogs contained sulfur dioxide and smoke particles.

The data the scientists used is shown below.



9B The average number of deaths per day from day 5 to day 8 was . . .

1 475

2 700

3 900

4 2800

9C The suggestion that sulfur dioxide in the smog was responsible for human deaths was . . .

1 a conclusion.

2 a hypothesis.

3 a piece of research.

4 a piece of evidence.

9D Which one of the following is a valid statement from the graph?

1 Sulfur dioxide was responsible for the deaths.

2 Smog was responsible for the deaths.

3 Sulfur dioxide could **not** be responsible for the deaths since the graphs do **not** match exactly.

4 Sulfur dioxide was probably responsible for the deaths but other factors may have been responsible.

END OF TEST

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Foundation Tier is earlier in this booklet.

HIGHER TIER

SECTION ONE

Questions **ONE** and **TWO**.

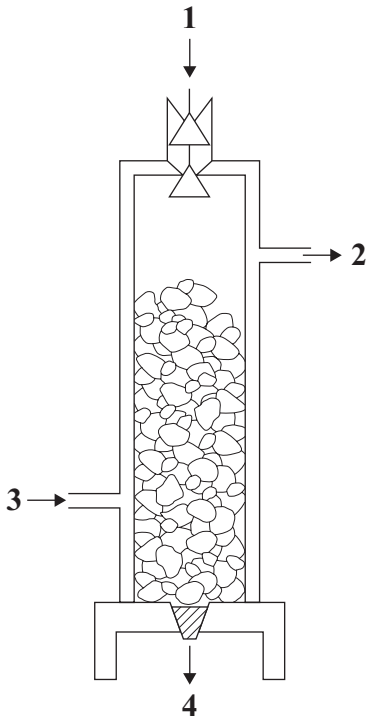
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows how limestone can be heated in a lime kiln to produce quicklime.



Match substances, **A**, **B**, **C** and **D**, with the labels **1–4** on the diagram.

A carbon dioxide

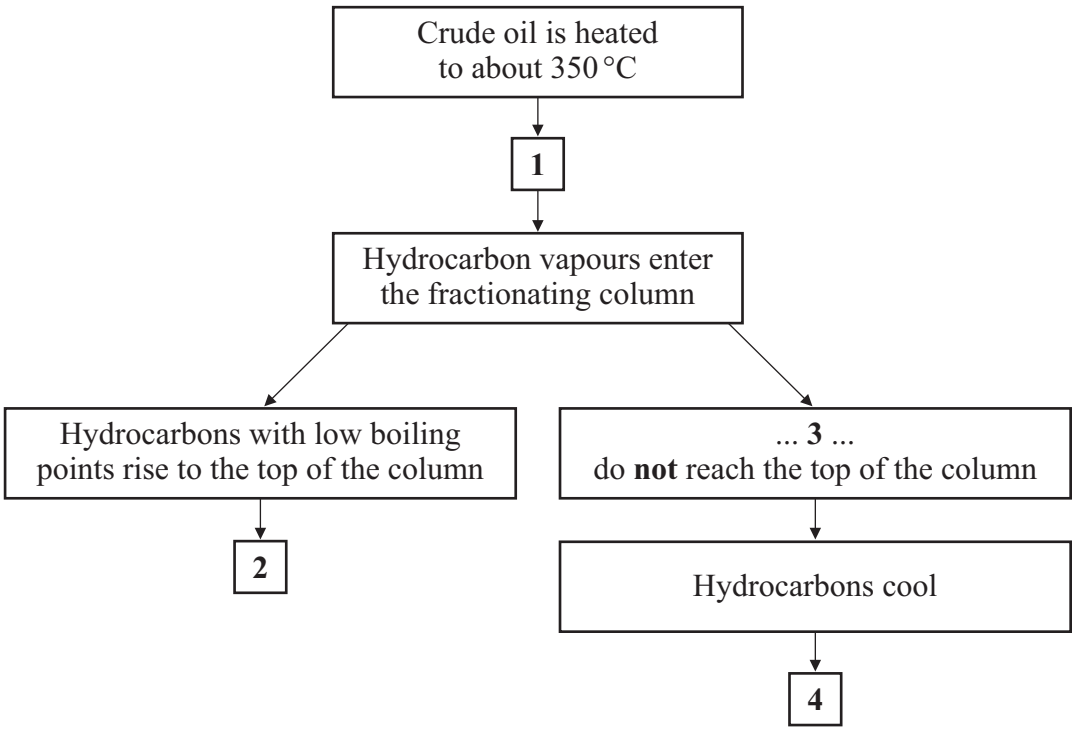
B hot air

C limestone

D quicklime

QUESTION TWO

The flow chart shows stages in the fractional distillation of crude oil.



Match statements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A Hydrocarbons in the crude oil turn to vapour

B Hydrocarbons collected as gases

C Hydrocarbons with high boiling points

D Hydrocarbons condense to form liquids

Turn over for the next question

SECTION TWO

Questions **THREE** to **NINE**.

Each of these questions has four parts.

In each part choose only **one** answer.

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QUESTION THREE

Four students each did three experiments to see how much quicklime they could get by heating 5.00 g of limestone. They heated the three separate samples of limestone until the mass of each sample no longer decreased.

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Limestone is in demand and is quarried on a vast scale, often in areas of natural beauty. The limestone is quarried using explosives.

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QUESTION FOUR

Scientists have been concerned for some time about the effects of releasing large amounts of sulfur dioxide into the atmosphere. Much of the sulfur dioxide is formed from burning fuels that contain sulfur. The equation for this reaction is:

$$S + O_2 \rightarrow SO_2$$

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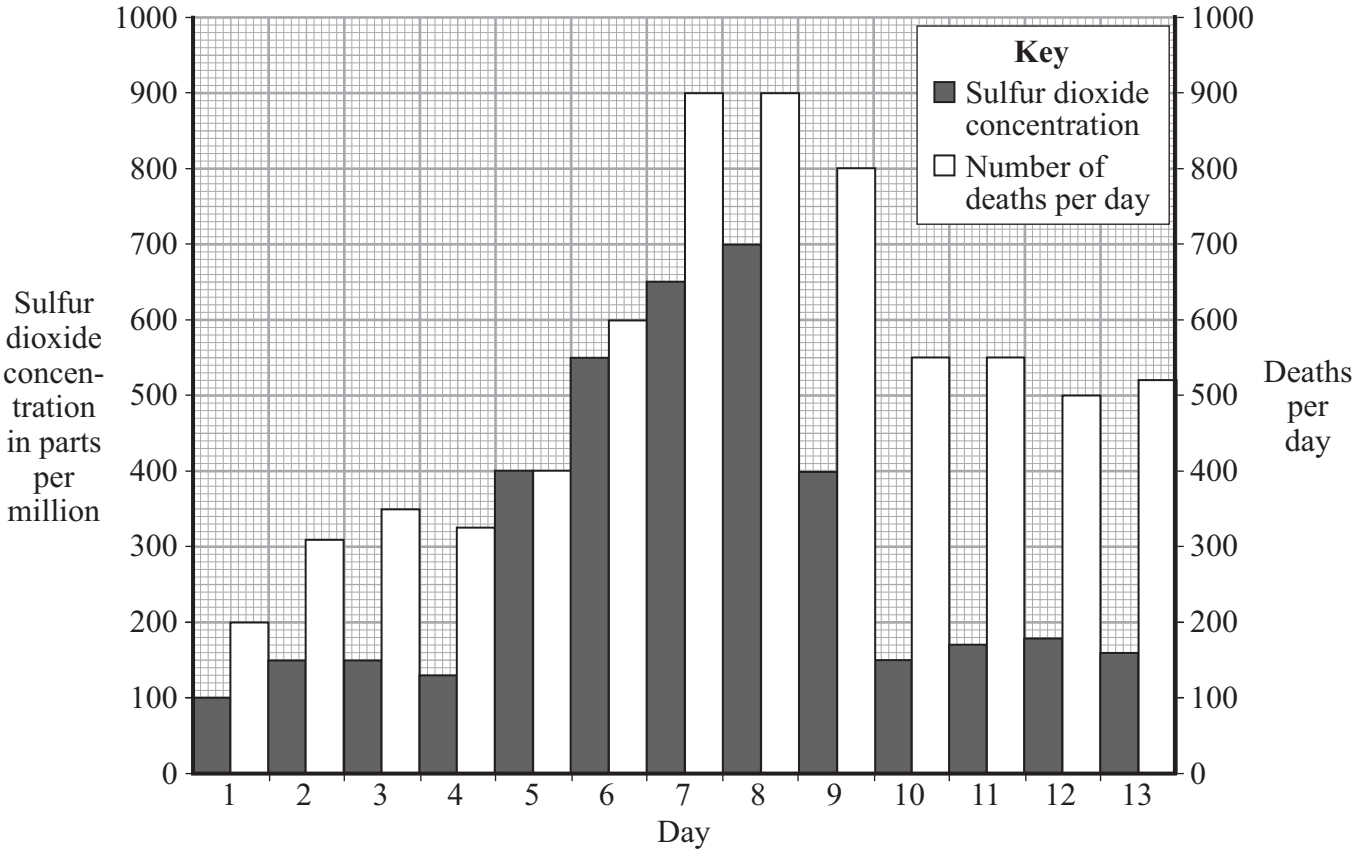

4B The average number of deaths per day from day 5 to day 8 was . . .

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4 2800

4C The suggestion that sulfur dioxide in the smog was responsible for human deaths was . . .

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3 a piece of research.

4 a piece of evidence.

4D Which one of the following is a valid statement from the graph?

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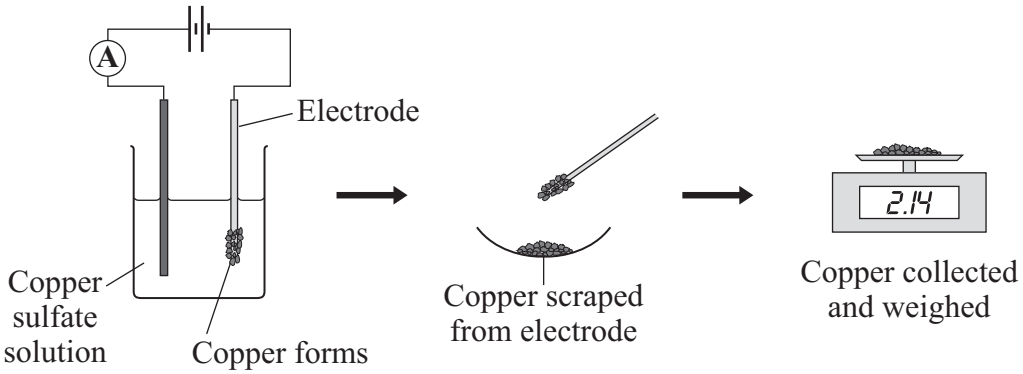
3 Sulfur dioxide could **not** be responsible for the deaths since the graphs do **not** match exactly.

4 Sulfur dioxide was probably responsible for the deaths but other factors may have been responsible.

Turn over for the next question

QUESTION FIVE

The diagram shows how copper can be extracted from a solution of copper sulfate using electrolysis.



The table shows how the mass of copper extracted in one minute changes with the current used in the experiment.

Current in amps	Mass of copper extracted in g per minute
1.0	0.12
1.5	0.14
2.0	0.24
2.5	0.30
3.0	0.36

5A There is an anomalous result at a current of . . .

1 1.5 A

2 2.0 A

3 2.5 A

4 3.0 A

5B All the results in the experiment were slightly higher than expected.

To provide more accurate results, the experiment could be repeated . . .

1 using a balance measuring to three decimal places.

2 using a wider range of currents.

3 drying the copper to constant mass before the final weighing.

4 carrying out the experiment three times at each current.

5C The results show that generally the amount of copper produced is . . .

1 directly proportional to the current used.

2 indirectly proportional to the current used.

3 independent of the current used.

4 inversely proportional to the current used.

5D The copper scraped from the electrode may **not** be 100% pure.

This is because . . .

1 it may contain some copper sulfate.

2 it still contains some of its original ore.

3 the copper produced quickly forms an alloy.

4 the electricity contaminates it.

Turn over for the next question

QUESTION SIX

This question is about the properties of iron and steel.

6A Production of cast iron from its ore is an example of . . .

1 oxidation.

2 reduction.

3 electrolysis.

4 combustion.

6B What is the best explanation for the softness of pure iron?

1 Iron atoms are very small so they move around easily.

2 There are bigger spaces in the metal after the impurities have been removed.

3 Pure materials are always softer than impure materials.

4 The atom layers can slide over each other quite easily.

6C To produce stainless steel from cast iron, it is necessary to . . .

1 remove the impurities.

2 remove the impurities and add other metals.

3 add other metals.

4 add extra carbon.

6D Aluminium is used in preference to iron for making cans for soft drinks.

The main reason is that . . .

1 aluminium is harder.

2 aluminium is more resistant to corrosion.

3 aluminium has a higher density.

4 aluminium is more reactive.

QUESTION SEVEN

Alloys are produced to combine the best properties of the metals used to make the alloy.

7A When aluminium is alloyed with other metals, such as copper and iron, . . .

1 it makes the alloy softer than pure aluminium.

2 it gives the alloy a greater strength than pure aluminium.

3 it makes the alloy less dense than pure aluminium.

4 it allows the alloy to corrode when it is no longer in use.

7B Which property will both the alloy and the metals it is made from **not** have?

1 good conductor of heat

2 good conductor of electricity

3 same density

4 can be hammered into shape

Shape memory alloys can 'remember' their shape and can return to it after they have been twisted into a different shape.

7C A shape memory alloy can be described as . . .

1 clever.

2 reliable.

3 sensible.

4 smart.

7D A shape memory alloy made of nickel and titanium contains 30 % titanium.

50 g of the alloy therefore contains . . .

1 30 g titanium and 20 g nickel.

2 35 g titanium and 15 g nickel.

3 25 g titanium and 25 g nickel.

4 15 g titanium and 35 g nickel.

QUESTION EIGHT

The table gives some information about the boiling points and combustion products of the first six alkanes.

			When one molecule of the alkane is completely burned	
Name	**Formula**	**Boiling point in °C**	**Number of molecules of CO_2 formed**	**Number of molecules of H_2O formed**
Methane	CH_4	–168	1	2
Ethane	C_2H_6	– 89	2	3
Propane	C_3H_8	– 42	3	4
Butane	C_4H_{10}	– 0.5		
Pentane	C_5H_{12}	+ 36		
Hexane	C_6H_{14}	+ 69		

8A Which one of the following statements is true about the fractional distillation of a mixture of the alkanes in the table?

1 Each of the fractions collected would contain just **one** alkane.

2 Hexane would be in the fraction selected at the highest temperature.

3 The hottest part of the column would be at the top.

4 Methane would be separated out at the bottom of the column.

8B Which one of the following is true about burning the alkanes?

1 As the size of the alkane molecules increases, the ratio of $CO_2 : H_2O$ molecules formed will eventually be 1:1

2 As the size of the alkane molecules increases, more and more oxygen molecules will be required to completely burn one molecule of the alkane.

3 The amount of water and carbon dioxide formed suggests that the alkanes with larger molecules will ignite more easily.

4 Since only water and carbon dioxide are formed on burning, the alkanes are environmentally-friendly fuels.

8C Burning the alkanes that have larger molecules tends to produce carbon monoxide along with carbon dioxide and water.

This suggests that these alkanes . . .

1 do **not** undergo complete combustion.

2 would make better fuels.

3 contain dissolved carbon monoxide gas.

4 can never be made totally pure.

8D To estimate the boiling point of heptane (C_7H_{16}) it would be best to use the boiling points from the table to plot . . .

1 a line graph with the number of carbon atoms as the independent, discrete variable.

2 a line graph with the number of carbon atoms as the categoric variable.

3 a bar chart with the number of carbon atoms as the independent, discrete variable.

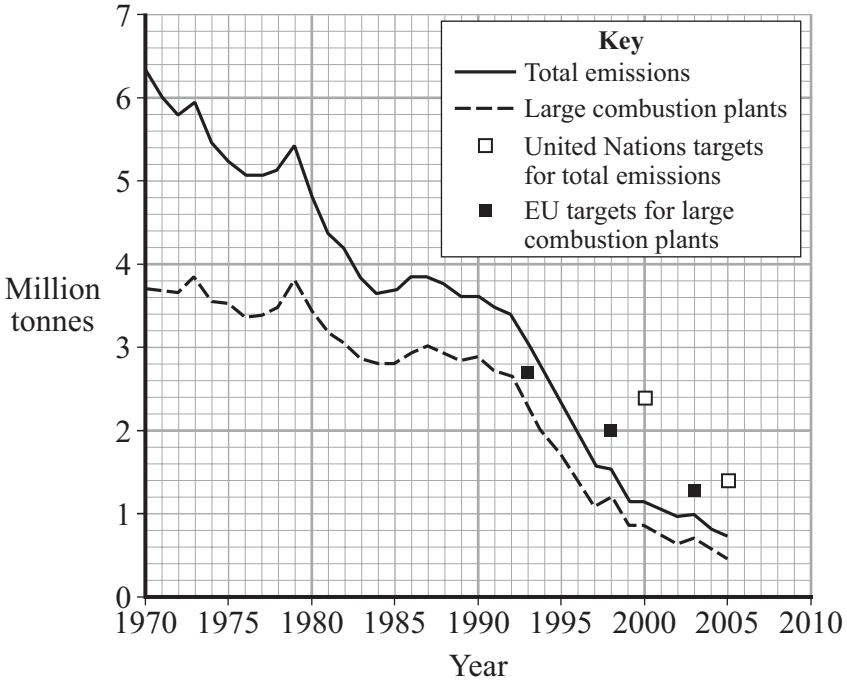
4 a bar chart with the number of carbon atoms as the categoric variable.

Turn over for the next question

QUESTION NINE

This passage is about sulfur dioxide gas released into the atmosphere in the United Kingdom.

The graph shows sulfur dioxide emissions and also targets set by the European Union and the United Nations.



Large combustion plants are:

- power stations
- oil refineries
- metal refineries
- some manufacturing industries.

Transport, domestic use and services contribute most of the other emissions.

Between 1990 and 2004, the amount of coal used in power stations fell by about 60%; sulfur dioxide emissions from power stations fell by about 82%.

The combustion of petroleum products contributed to 19% of all emissions in 2004, down 77% since 1990. This is mainly due to industry's use of gas rather than oil.

The already small amount of sulfur dioxide emitted from cars and lorries has fallen due to the introduction of ultra-low sulfur petrol and diesel fuels.

9A A general conclusion that can be made from the data is that . . .

1 total emissions of sulfur dioxide have fallen every year since 1970.

2 emissions of sulfur dioxide from large combustion plants fell more quickly than total emissions between 1970 and 1990.

3 from 1970 to 1980, total emissions fell by about 1.5 million tonnes.

4 total emissions were greater in 1990 than in 1980.

9B Sulfur dioxide emissions fell quickly from 1990 onwards.

One of the main reasons for this was . . .

1 the use of ultra-low sulfur petrol and diesel fuels.

2 the use of gas instead of oil in industry.

3 the reduction in the use of coal in power stations.

4 the reduction in the use of coal to heat houses.

9C The graph indicates that, of the emission targets set for the United Kingdom . . .

1 all the targets have been reached.

2 only the targets for total emissions have been reached.

3 all except **one** of the targets for emissions from large combustion plants have been reached.

4 none of the targets has been reached.

9D The European Union target for total emissions for the United Kingdom in 2010 is 585 thousand tonnes.

From the evidence in this question, . . .

1 it is probable that this target will be reached.

2 the increasing number of cars will make it difficult to reach this target.

3 it is unlikely that the target will be reached.

4 the target has already been reached.

END OF TEST

There are no questions printed on this page