Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
June 2012

Science A

Unit Chemistry C1a (Products from Rocks)

Chemistry

Unit Chemistry C1a (Products from Rocks)

CHY1AP

F&H

Friday 22 June 2012 Afternoon Session

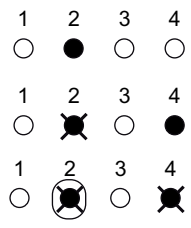
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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 16 of this booklet.

FOUNDATION TIER

Section One

Questions **ONE** to **FIVE**.

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 metals.

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

A aluminium

B copper

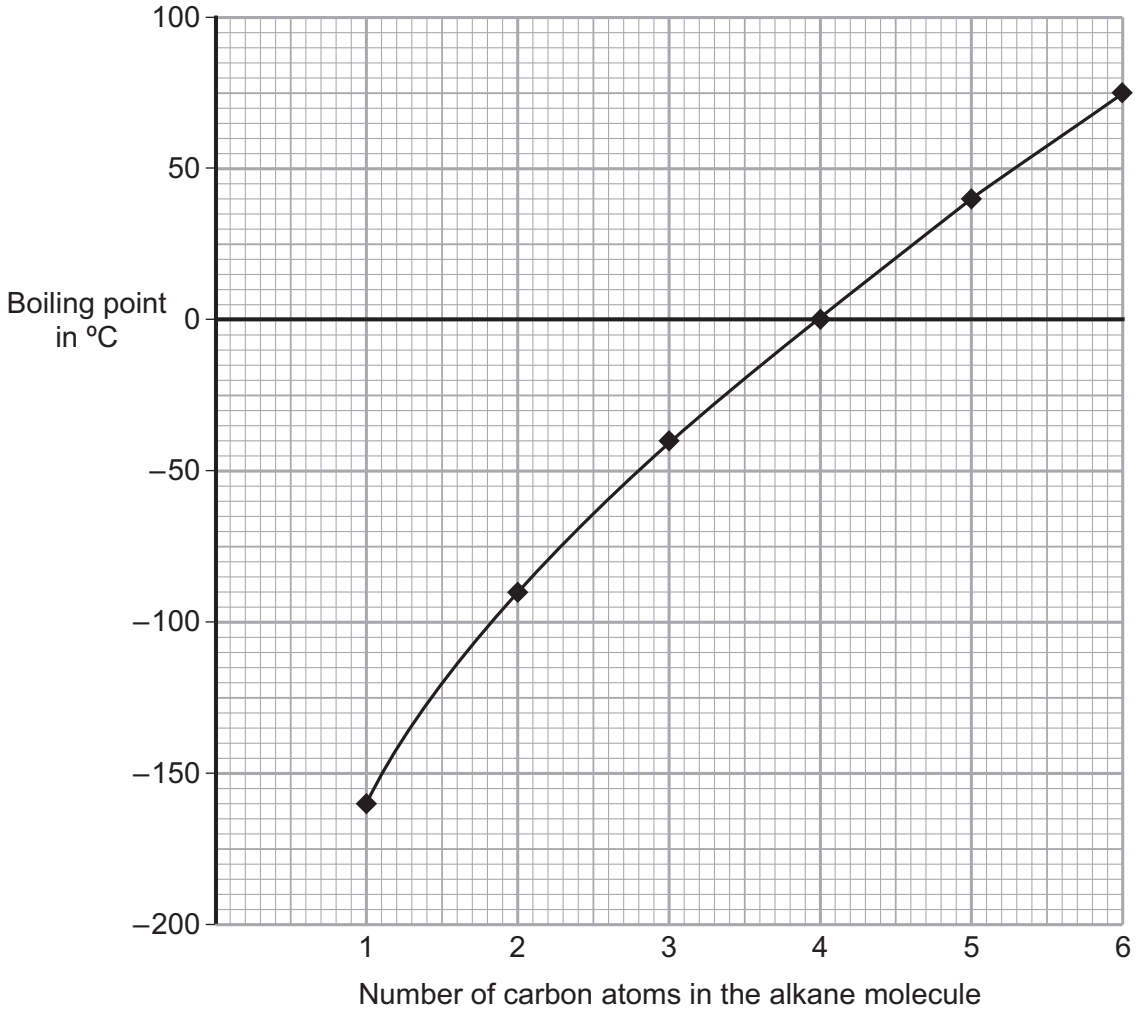
C iron

D sodium

1	It is represented by the symbol Na
2	It is used for electrical wiring and in plumbing
3	It is used in aircraft construction because of its low density
4	It can be converted into stainless steel

QUESTION TWO

The general formula for the alkanes is C_nH_{2n+2}. The graph shows the boiling points of six alkanes.



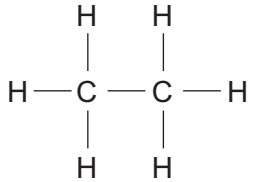
Match values, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the sentences.

A 0

B 6

C 12

D −90

The alkane with the structural formula  has a boiling point of . . . **1** . . . °C.

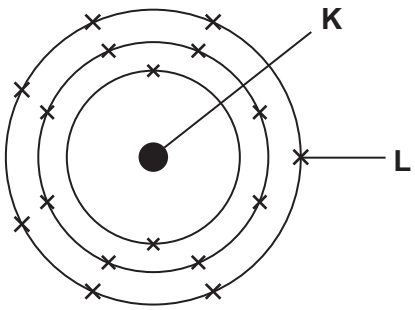
The boiling point of the alkane with four carbon atoms in each molecule is . . . **2** . . . °C.

The alkane that is a liquid at 50 °C has . . . **3** . . . carbon atoms in each molecule.

The alkane with five carbon atoms has . . . **4** . . . hydrogen atoms in each molecule.

QUESTION THREE

The diagram shows a chlorine atom.



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

A the nucleus

B a bond

C an electron

D an element

Chlorine is . . . **1** . . . .

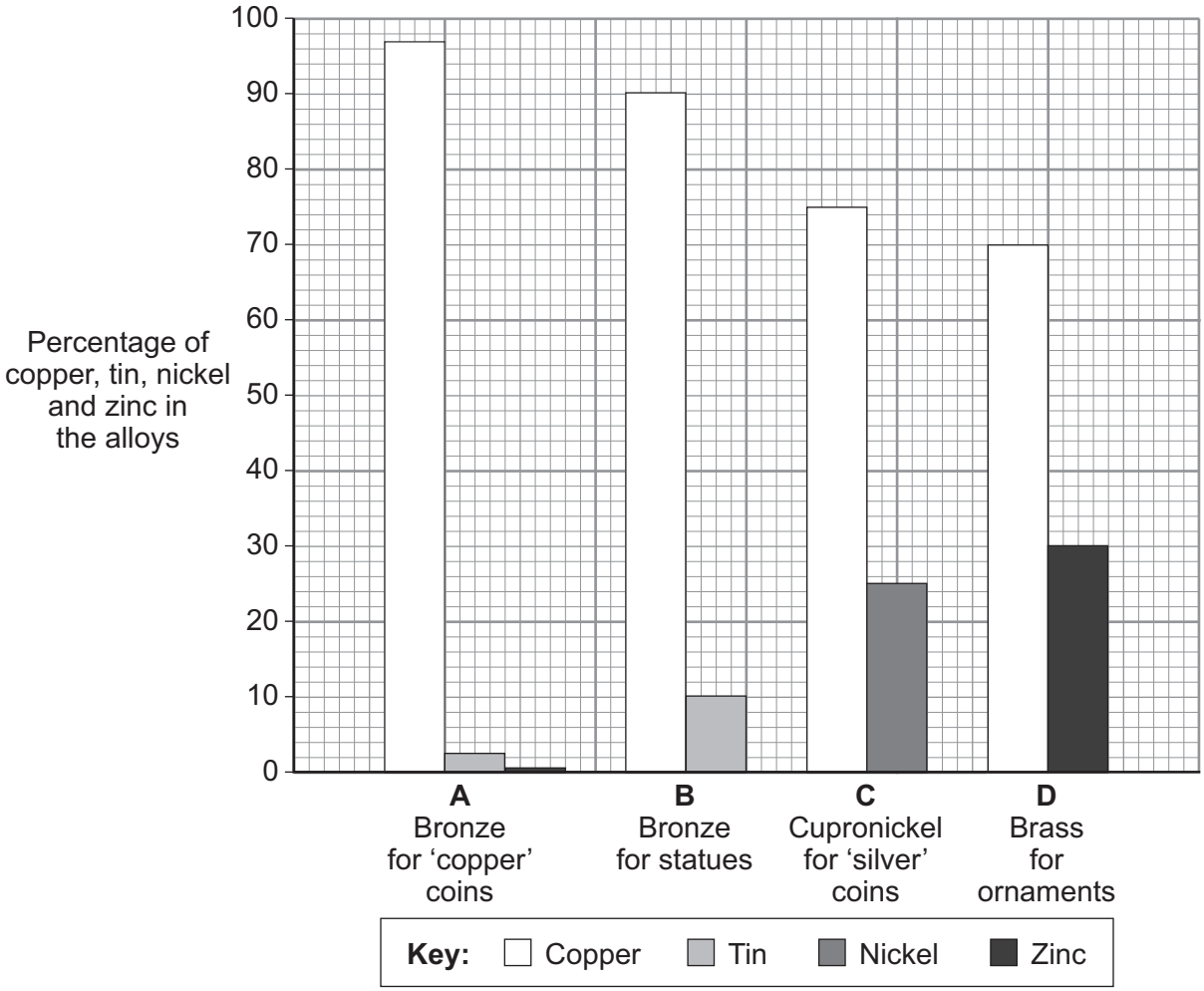
K is . . . **2** . . . .

L is . . . **3** . . . .

In a molecule of chlorine, two atoms are held together by . . . **4** . . . .

QUESTION FOUR

The bar chart shows the composition of four copper alloys, **A**, **B**, **C** and **D**.



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

A bronze for 'copper' coins

B bronze for statues

C cupronickel for 'silver' coins

D brass for ornaments

1	It is an alloy of three metals
2	It contains copper and one other metal in the ratio 75:25
3	It is the alloy with the lowest proportion of copper
4	It contains copper and tin only

QUESTION FIVE

This question is about some substances that can be obtained from copper carbonate.

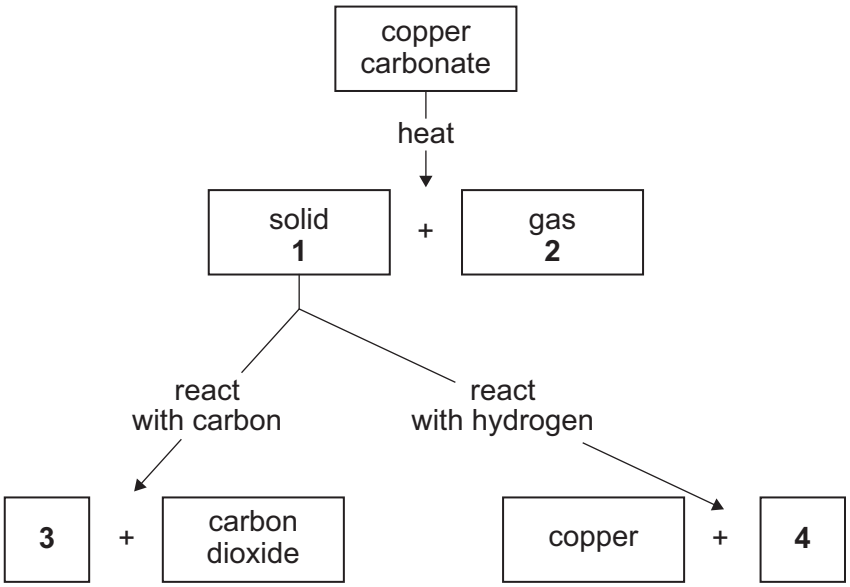
Match substances, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the flow chart.

A carbon dioxide

B copper

C copper oxide

D water



Turn over for the next question

Section Two

Questions **SIX** to **NINE**.

Each of these questions has four parts.

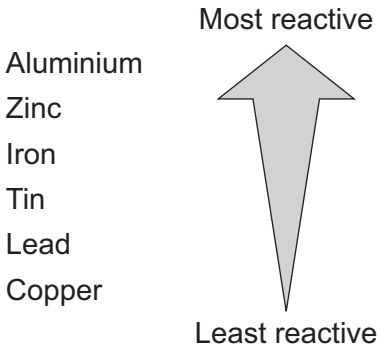
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION SIX

The metal tin occurs in the Earth's crust as the compound called cassiterite, SnO_2

Reactivity of some metals



6A How would you expect tin to be extracted from its oxide?

1 by mixing the oxide with copper and heating strongly

2 by electrolysis of the solid oxide

3 by mixing the oxide with carbon and heating strongly

4 by electrolysis of a solution of the oxide

6B The main reason why food cans made from steel (iron) are coated with tin is because . . .

1 tin has a lower density than iron.

2 tin is less reactive than iron.

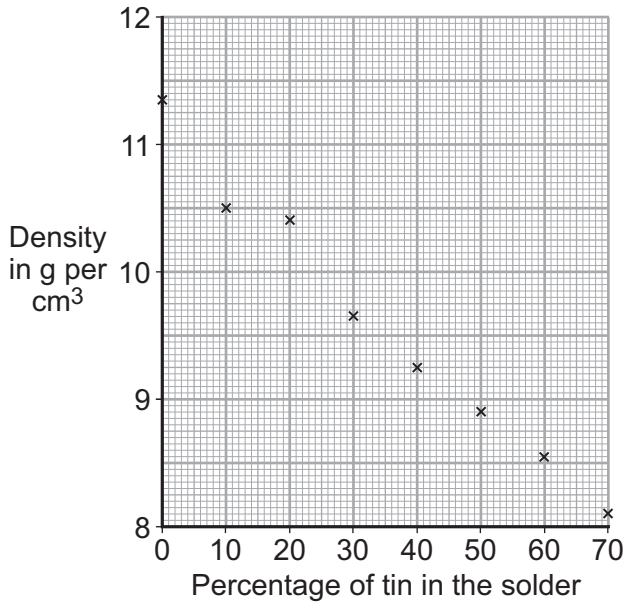
3 tin is a better conductor of heat than iron.

4 tin is stronger than iron.

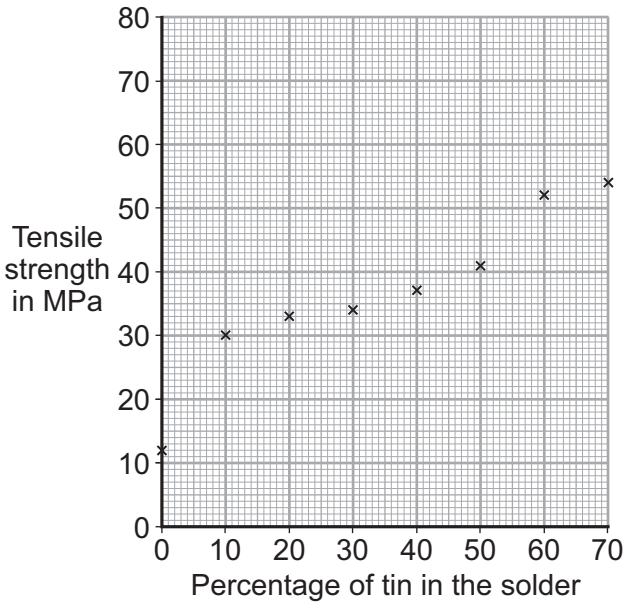
Solder is an alloy of lead and tin.

The graphs show how the percentage (%) of tin in the solder affects the density (**Graph 1**) and tensile strength (**Graph 2**) of the solder.

Graph 1



Graph 2



6C What is the density of lead in g per cm^3?

1 8.17

2 8.90

3 9.60

4 11.35

6D Increasing the percentage (%) of tin in the solder *. . .*

1 increases the density and increases the tensile strength.

2 increases the density and decreases the tensile strength.

3 decreases the density and decreases the tensile strength.

4 decreases the density and increases the tensile strength.

QUESTION SEVEN

A student wanted to find out how much calcium oxide can be obtained by heating 4.00 grams of calcium carbonate.

The student:

- heated 4.00 grams of calcium carbonate in a test tube with a Bunsen burner for a total of 5 minutes
- calculated the mass of the contents in the test tube after each minute
- repeated the experiment three times.

The results are shown in the table.

	Time in minutes	**0**	**1**	**2**	**3**	**4**	**5**
Mass of the contents of the test tube in g	**Test 1**	4.00	3.41	3.10	2.74	2.56	2.41
	Test 2	4.00	3.39	3.06	2.70	2.52	2.36
	Test 3	4.00	3.43	3.17	2.80	2.59	2.43
	Test 4	4.00	2.97	2.81	2.65	2.36	2.01

7A One variable that is difficult to control in these tests is . . .

1 the mass of the test tube.

2 the mass of the calcium carbonate put into the test tube.

3 the temperature of the Bunsen burner flame.

4 the number of times the experiment is repeated.

7B What is the correct mean value for the student's results after heating for 5 minutes?

1 2.36 g

2 2.40 g

3 2.42 g

4 9.21 g

The maximum mass of calcium oxide that can be obtained from 4.00 grams of calcium carbonate is 2.24 grams.

7C What mass of carbon dioxide will be obtained by complete decomposition of 4.00 grams of calcium carbonate?

1 1.76 g

2 1.79 g

3 6.24 g

4 8.96 g

7D There is a mistake in the way that the student did the experiment.

The mistake is that the student . . .

1 did not heat the calcium carbonate until there was no further loss in mass.

2 used a mass of calcium carbonate that was too small.

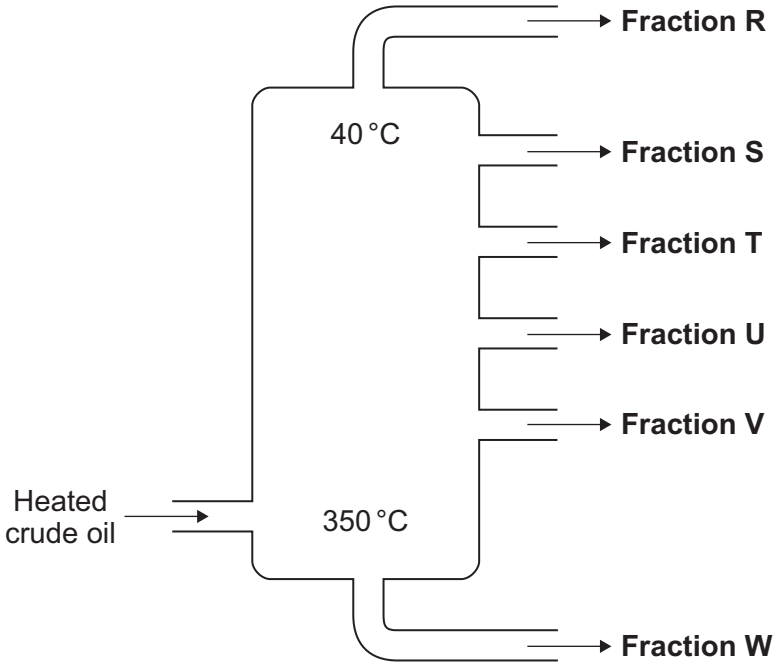
3 used a test tube that was too large.

4 did not find the mass of the contents of the tube every 30 seconds.

Turn over for the next question

QUESTION EIGHT

The diagram shows a fractionating column.



8A Each fraction collected is . . .

1 a single alkane.

2 a mixture of alkanes with similar boiling points.

3 a mixture of alkanes with the same chemical formula.

4 a mixture of alkanes that are liquids.

8B Which row in the table describes the alkanes in **Fraction R**?

1	small molecules	are gases
2	small molecules	are liquids
3	large molecules	are gases
4	large molecules	are liquids

8C Which statement is correct for the alkanes in **Fraction W**?

1 they are compounds of carbon, hydrogen and oxygen

2 they have the general formula C_nH_{2n-2}

3 they have boiling points below 100 °C

4 they are saturated compounds

8D **Fraction T** is used to make diesel fuel.

Why are fuel companies producing low-sulfur diesel fuel for use in vehicles?

1 to increase the miles per litre vehicles will travel

2 to reduce the amount of acid rain

3 to reduce global warming

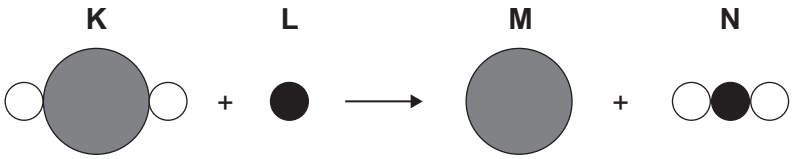
4 to increase levels of oxygen in the atmosphere

Turn over for the next question

QUESTION NINE

The diagram represents a reaction between substances **K** and **L** to produce two substances, **M** and **N**.

Each circle represents an atom.



9A Substance **N** is . . .

1 an element.

2 a mixture of elements.

3 a compound.

4 a mixture of compounds.

9B Which substances will be in the periodic table?

1 **K** and **N**

2 **K** and **L**

3 **M** and **N**

4 **L** and **M**

9C A molecule of substance **K** . . .

1 contains three different elements.

2 will have three separate nuclei.

3 will not have any chemical bonds.

4 will not contain any electrons.

9D In the formation of substances **M** and **N** from substances **K** and **L** . . .

1 no new chemical bonds are formed.

2 different atoms are formed.

3 there is no change in total mass.

4 there is an increase in the number of atoms.

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

This question is about some substances that can be obtained from copper carbonate.

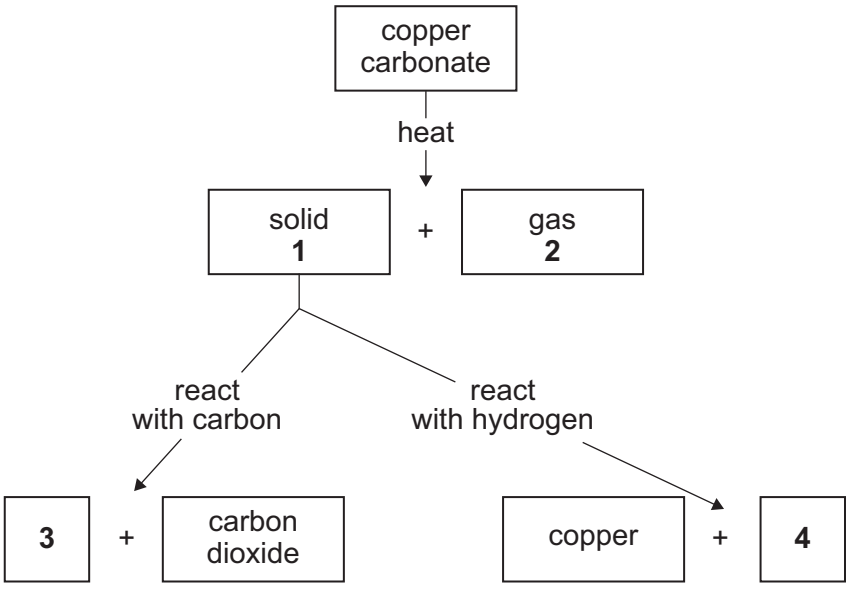
Match substances, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the flow chart.

A carbon dioxide

B copper

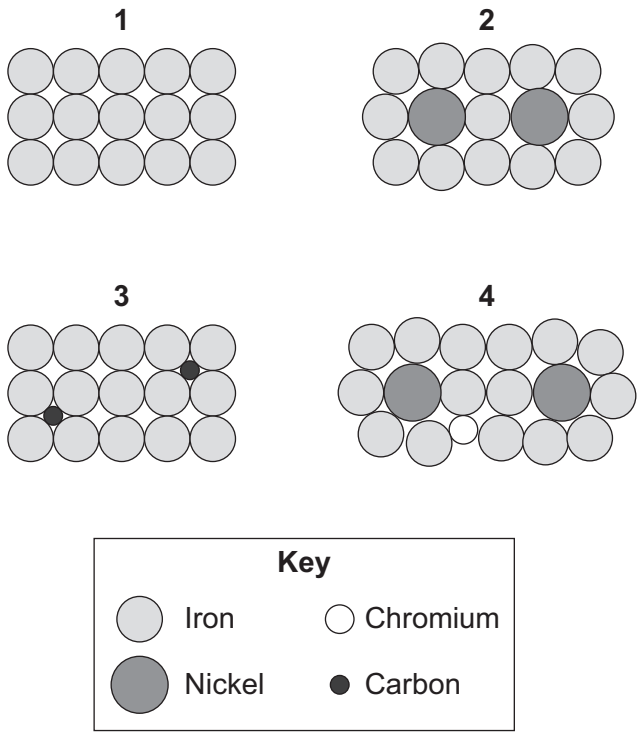
C copper oxide

D water



QUESTION TWO

The diagrams show the arrangements of atoms in a pure metal and in some of its alloys.
The different circles represent atoms of different elements.



Match descriptions, **A**, **B**, **C** and **D**, with the numbers **1**–**4** on the diagrams.

A it is probably the softest substance

B it is the alloy that contains only two metals

C it is an alloy that contains only one metal

D it contains the largest number of different elements

Turn over for the next question

Section Two

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

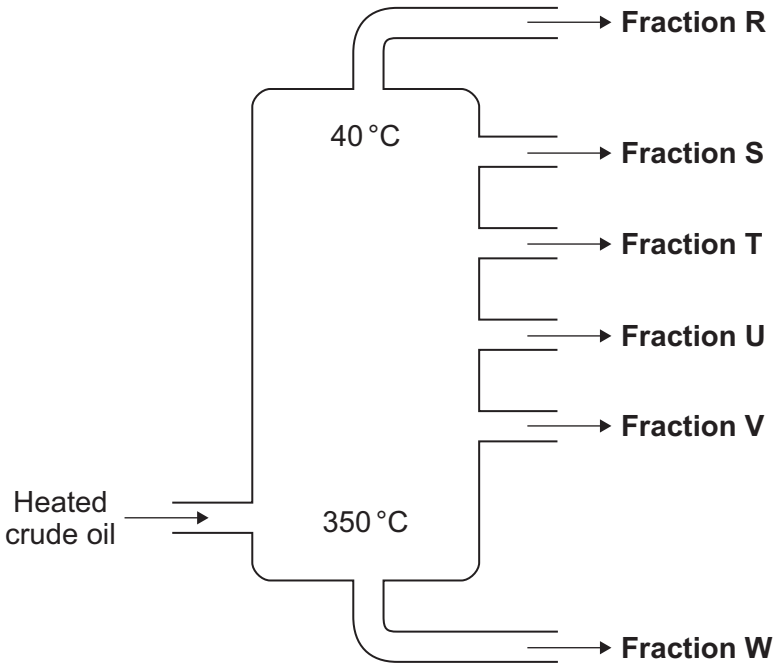
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION THREE

The diagram shows a fractionating column.



3A Each fraction collected is . . .

1 a single alkane.

2 a mixture of alkanes with similar boiling points.

3 a mixture of alkanes with the same chemical formula.

4 a mixture of alkanes that are liquids.

3B Which row in the table describes the alkanes in **Fraction R**?

1	small molecules	are gases
2	small molecules	are liquids
3	large molecules	are gases
4	large molecules	are liquids

3C Which statement is correct for the alkanes in **Fraction W**?

1 they are compounds of carbon, hydrogen and oxygen

2 they have the general formula C_nH_{2n-2}

3 they have boiling points below 100 °C

4 they are saturated compounds

3D **Fraction T** is used to make diesel fuel.

Why are fuel companies producing low-sulfur diesel fuel for use in vehicles?

1 to increase the miles per litre vehicles will travel

2 to reduce the amount of acid rain

3 to reduce global warming

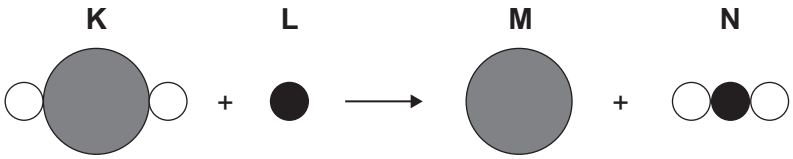
4 to increase levels of oxygen in the atmosphere

Turn over for the next question

QUESTION FOUR

The diagram represents a reaction between substances **K** and **L** to produce two substances, **M** and **N**.

Each circle represents an atom.



4A Substance **N** is . . .

1 an element.

2 a mixture of elements.

3 a compound.

4 a mixture of compounds.

4B Which substances will be in the periodic table?

1 **K** and **N**

2 **K** and **L**

3 **M** and **N**

4 **L** and **M**

4C A molecule of substance **K** . . .

1 contains three different elements.

2 will have three separate nuclei.

3 will not have any chemical bonds.

4 will not contain any electrons.

4D In the formation of substances **M** and **N** from substances **K** and **L** . . .

1 no new chemical bonds are formed.

2 different atoms are formed.

3 there is no change in total mass.

4 there is an increase in the number of atoms.

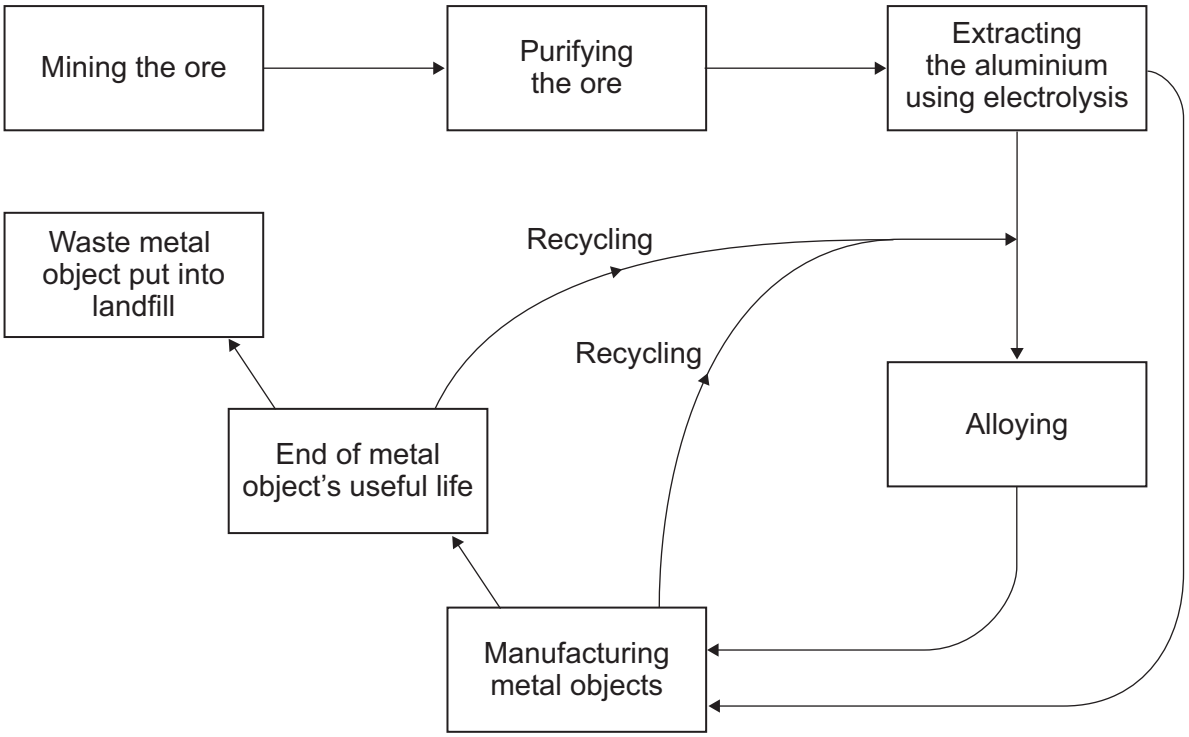
Turn over for the next question

QUESTION FIVE

Aluminium can be obtained in two ways:

- by extracting aluminium from its ore
- by recycling aluminium.

The flow chart gives information about these two ways.



5A One advantage of extracting aluminium from its ore is that . . .

1 aluminium ore is a renewable resource.

2 the metal obtained from aluminium ore contains very few impurities.

3 the metal obtained does not corrode easily.

4 aluminium ore needs to be purified.

5B One economic advantage of recycling aluminium, rather than extracting aluminium from its ore, is that . . .

1 the metal produced is pure.

2 it uses less energy to produce the metal.

3 the metal produced is a smart alloy.

4 it takes more time to produce the metal.

5C In Britain, about 40 % of all the aluminium used is recycled.

Which of the following would definitely **not** increase the percentage of aluminium that is recycled?

1 an increase in the amount of aluminium mined

2 an increase in the cost of objects made from aluminium

3 opening more landfill sites

4 the employment of more people in the recycling industry

5D Which of the following is an environmental advantage of recycling more aluminium?

1 a reduction in the cost of objects made from aluminium

2 a reduction in the overall use of aluminium

3 a reduction in the damage to the landscape

4 a reduction in the cost of recycling

Turn over for the next question

QUESTION SIX

When water is added to calcium oxide, heat energy is released.

6A Which of the following is a correctly balanced equation for the reaction of calcium oxide with water?

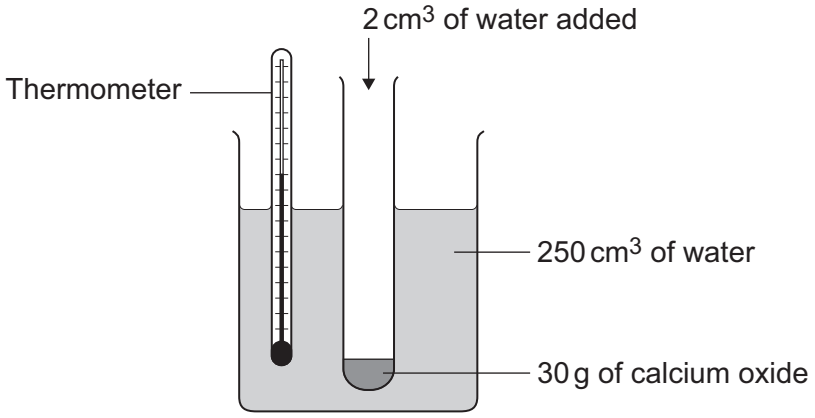
1 $CaO + 2H_2O \rightarrow Ca(OH)_2$

2 $CaO + H_2O \rightarrow CaCO_3 + CO_2$

3 $CaO + H_2O \rightarrow Ca(OH)_2$

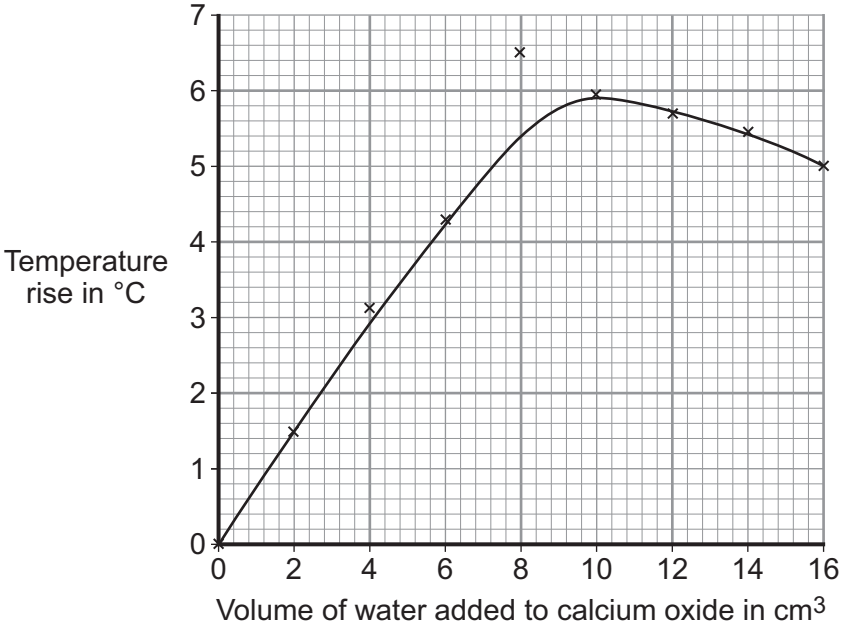
4 $2CaO + H_2O \rightarrow 2Ca(OH)_2$

A student added 2 cm^3 of water to a 30 gram sample of calcium oxide and measured the rise in temperature using the apparatus shown in the diagram.



The student repeated the experiment, but added different volumes of water to new 30 gram samples of calcium oxide.

The student's results are shown in the graph.



6B There is a decrease in temperature rise when more than 10 cm^3 of water has been added.

The reason for this is that . . .

1 the calcium oxide has completely reacted to produce calcium carbonate.

2 there is excess water.

3 no calcium oxide can react.

4 a different chemical reaction happens.

6C The graph has a 'line of best fit'.

Using the information on the graph, the temperature rise for 8 cm^3 of water is . . .

1 5.2 °C

2 5.4 °C

3 6.0 °C

4 6.5 °C

6D Which row in the table correctly identifies some of the variables in this experiment?

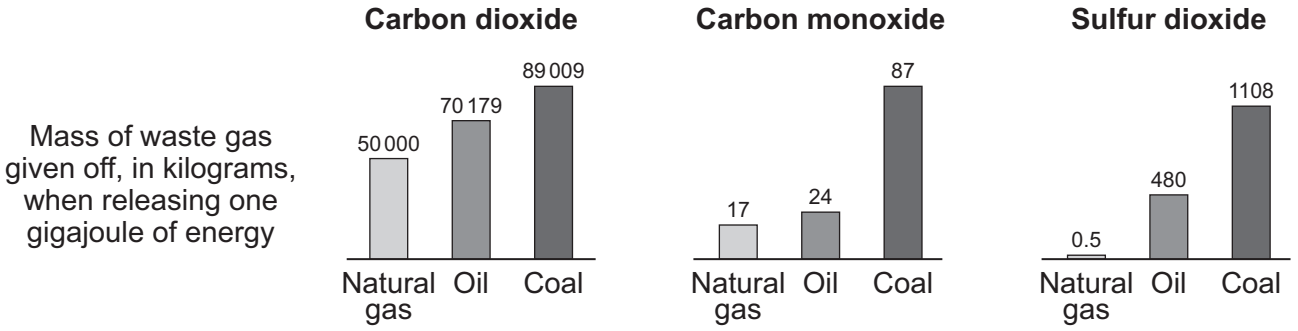
	Independent	**Dependent**	**Control**
1	Final temperature in the beaker	Volume of water added to the calcium oxide	Volume of water in the beaker
2	Temperature rise in the beaker	Volume of water added to the calcium oxide	Mass of calcium oxide
3	Volume of water added to the calcium oxide	Temperature rise in the beaker	The same apparatus
4	Mass of calcium oxide	Final temperature in the beaker	Temperature rise in the beaker

Turn over for the next question

QUESTION SEVEN

Natural gas (mainly methane), oil and coal are burned in power stations.

The quantities of the waste gases, carbon dioxide, carbon monoxide and sulfur dioxide produced by burning these fuels are shown in the bar charts.



7A From the information in the bar charts a correct conclusion is that . . .

1 oil and coal contain hydrocarbons with larger molecules than natural gas.

2 coal undergoes complete combustion but natural gas and oil do not.

3 coal burns to release more energy than oil or natural gas.

4 small volumes of natural gas occur in coal seams.

Research continues into the use of natural gas in power stations.

The following is an extract from an article in a science journal:

> One potential option for gas-fired power stations is to capture the carbon before the fuel is burned. Natural gas is converted to carbon monoxide and hydrogen. The carbon monoxide is converted to carbon dioxide, which is then removed. The hydrogen is burned in the power station.

The equations below show two reactions that take place:

$$CH_4 + H_2O \rightarrow CO + 3H_2$$

$$CO + H_2O \rightarrow CO_2 + H_2$$

7B Which substances are oxidised in these reactions?

1 carbon monoxide and water

2 carbon monoxide and carbon dioxide

3 methane and carbon monoxide

4 methane and carbon dioxide

7C One reason why hydrogen is preferred to the other fuels is that . . .

1 when hydrogen burns there are no waste products.

2 when hydrogen burns only water is produced.

3 hydrogen is very flammable and can burn in the absence of oxygen.

4 hydrogen reacts with carbon monoxide to produce carbon dioxide.

7D Sulfur dioxide (SO_2) can be removed from the waste gases from power stations by reacting it with calcium carbonate ($CaCO_3$), calcium oxide (CaO) or calcium hydroxide ($Ca(OH)_2$).

Which of the following is the correctly balanced equation to show one of these reactions?

1 $SO_2 + 2CaO \rightarrow CaSO_3$

2 $SO_2 + CaCO_2 \rightarrow CaSO_3 + CO_2$

3 $SO_2 + CaCO_3 \rightarrow CaSO_3 + CO_2$

4 $SO_2 + Ca(OH)_2 \rightarrow CaSO_3 + 2H_2O$

Turn over for the next question

QUESTION EIGHT

A scientist investigated the chemistry of four metals, **W**, **X**, **Y** and **Z**.

These are the results.

- The oxides of **W** and **Y** were reduced to the metal when mixed with carbon and heated.
- The oxide of **Z** could not be reduced by heating with carbon.
- The oxide of **X** decomposed to the metal on heating alone.
- **Y** gave off hydrogen gas with dilute acid but **W** and **X** did not.

8A Starting with the most reactive, what is the order of reactivity for the four metals?

1 **X**, **W**, **Y**, **Z**

2 **Z**, **Y**, **W**, **X**

3 **X**, **W**, **Z**, **Y**

4 **Z**, **W**, **Y**, **X**

8B Which metal is most likely to be found in the ground as the pure metal?

1 **W**

2 **X**

3 **Y**

4 **Z**

Titanium is extracted from titanium chloride by mixing the titanium chloride with sodium and heating the mixture in a furnace.

The extraction of titanium is a batch process. This means that the furnace does not operate continuously, but is cooled after each operation so that the titanium can be removed.

8C Which row in the table correctly describes the reaction for extraction of titanium?

	Why the reaction occurs	**Products of the reaction**
1	Sodium is more reactive than titanium	Titanium, sodium and chlorine
2	Titanium is more reactive than sodium	Titanium and chlorine
3	Titanium is more reactive than sodium	Titanium and sodium chloride
4	Sodium is more reactive than titanium	Titanium and sodium chloride

8D The extraction of iron using a blast furnace is a continuous process.

Over a period of 12 months, the batch method for extraction of titanium requires much more energy per tonne of metal than the continuous method for extraction of iron.

One reason for this is because . . .

1 the batch process is completed more quickly.

2 iron is more dense than titanium.

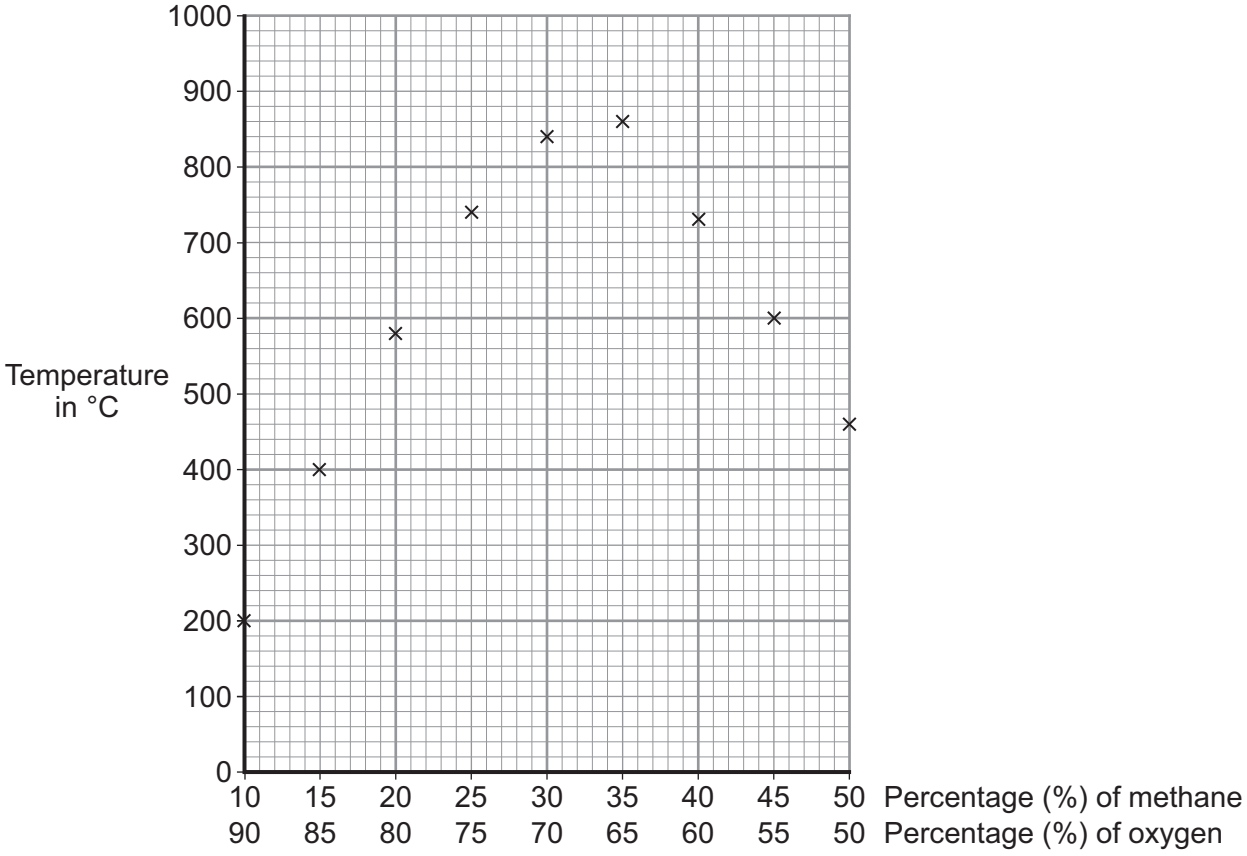
3 the furnace used for titanium is not maintained at a high temperature.

4 titanium chloride is not as pure as iron oxide.

Turn over for the next question

QUESTION NINE

The graph below shows the temperatures reached when different mixtures of methane gas and oxygen are burned.



9A What is the maximum temperature that can be reached by burning methane and oxygen?

1 840 °C

2 890 °C

3 980 °C

4 1000 °C

9B The maximum temperature value could be found more accurately if . . .

1 all the readings were repeated.

2 the readings close to the maximum were repeated.

3 readings at smaller percentage intervals were recorded.

4 a thermometer with smaller scale divisions was used.

The equation for the combustion of methane can be written as:

$$CH_4 + \mathbf{n}O_2 \rightarrow CO_2 + 2H_2O$$

9C What value of **n** is needed to balance the equation?

1 1.5

2 2

3 3

4 4

9D The equation below shows the complete combustion of propane.

$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$

To completely burn 100 cm^3 of propane requires 500 cm^3 of oxygen.

What volume of oxygen is required to completely burn 100 cm^3 of butane, C_4H_{10}?

1 550 cm^3

2 600 cm^3

3 650 cm^3

4 666 cm^3

END OF TEST

There are no questions printed on this page