AQA GCSE SCIENCE A (CHEMISTRY)

CHEMISTRY



EXAM QUESTION PACK

UNIT C1a OBJECTIVE TEST CHY1AP PAPERS

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

Science A

Unit Chemistry C1a (Products from Rocks)

Chemistry

Unit Chemistry C1a (Products from Rocks)

CHY1AP

F&H

Tuesday 6 November 2012 Afternoon Session

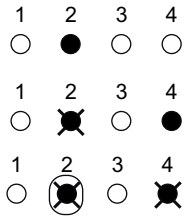
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet
- a ruler.

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**.

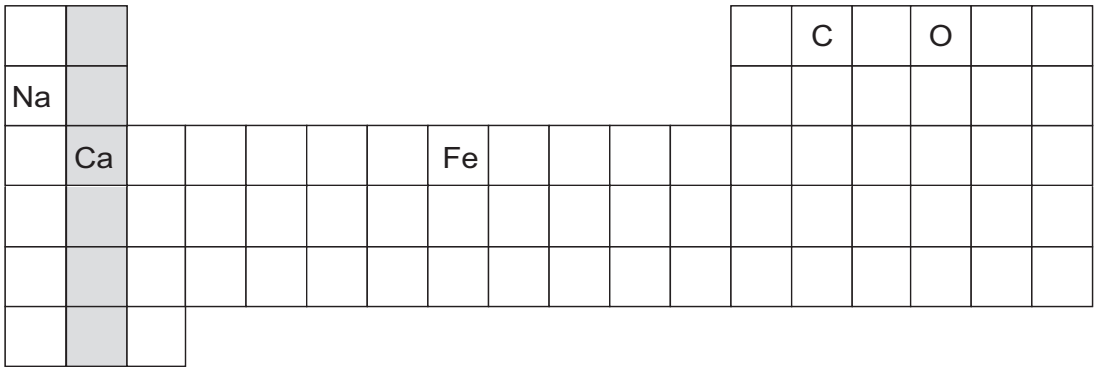
Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows part of the periodic table.

One vertical column has been shaded.



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

A compounds

B elements

C groups

D properties

Some of the substances shown in the periodic table can react together to form . . . **1** . . . .

The substances in the periodic table are . . . **2** . . . .

Substances in the same vertical column have similar chemical . . . **3** . . . .

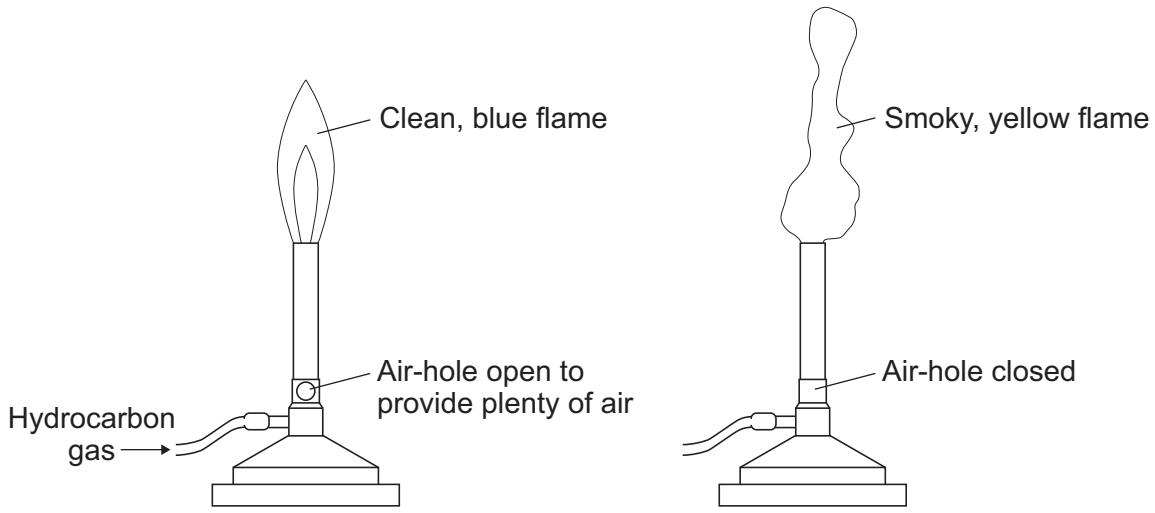
The vertical columns are called . . . **4** . . . .

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QUESTION TWO

The diagram shows a hydrocarbon gas burning from a Bunsen burner.

The flame is different when the air-hole is open compared with when it is closed.



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

A carbon

B carbon monoxide

C carbon dioxide

D oxygen

With the air-hole open, the two main products of combustion are water and . . . **1** . . . .

Water is formed when hydrogen in the hydrocarbon gas reacts with . . . **2** . . . .

With the air-hole closed, another gas produced during combustion is . . . **3** . . . .

The smoky, yellow flame contains black particles of . . . **4** . . . .

Turn over for the next question

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QUESTION THREE

These are some of the properties of four metals.

Metal		Electrical conductivity	Density in grams per cm^3	Melting point in °C	Boiling point in °C
A	Aluminium	very good	2.7	660	2470
B	Iron	good	7.8	1535	2750
C	Mercury	very good	13.6	–39	357
D	Potassium	good	0.9	64	774

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

	What we can say about the metal
1	It is a liquid at room temperature (20 °C).
2	It is used in making overhead electricity cables because it is a very good conductor and has a low density.
3	It has the highest melting and boiling points.
4	It will float on a liquid that has a density of 1.0 grams per cm^3.

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QUESTION FOUR

The table shows information about four fuels, **A**, **B**, **C** and **D**.

	Fuel	Type of substance	Number of carbon atoms per molecule	Energy released per gram of fuel	Mass of carbon dioxide produced per gram of fuel
A	LPG	Alkanes	3 or 4	50 kJ	3.0 g
B	Diesel	Alkanes	16–20	53 kJ	3.1 g
C	Ethanol	Alcohol	2	30 kJ	1.9 g
D	Hydrogen	Element	0	118 kJ	0.0 g

Match fuels, **A**, **B**, **C** and **D**, with the sentences **1**–**4** below.

1 This fuel has the lowest boiling point of the alkane fuels.

2 This fuel does not produce carbon dioxide when burned.

3 This fuel releases the least amount of energy per gram when burned.

4 This fuel has the most carbon atoms in its molecules.

Turn over for the next question

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QUESTION FIVE

A mixture of iron oxide and aluminium reacts when heated.

This is the balanced equation for the reaction:

$$Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$$

Symbols	
Fe	Iron
O	Oxygen
Al	Aluminium

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

A electrons

B bonds

C products

D elements

Iron oxide and aluminium are the reactants. Aluminium oxide and iron are the . . . **1** . . . .

Aluminium atoms and oxygen atoms combine by transferring . . . **2** . . . .

The particles (ions) in aluminium oxide are held together by . . . **3** . . . .

The equation is balanced because, in the reaction, there is no change in the total number of atoms of each of the . . . **4** . . . .

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Turn over for the next question

Section Two

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

Each of these questions has four parts.

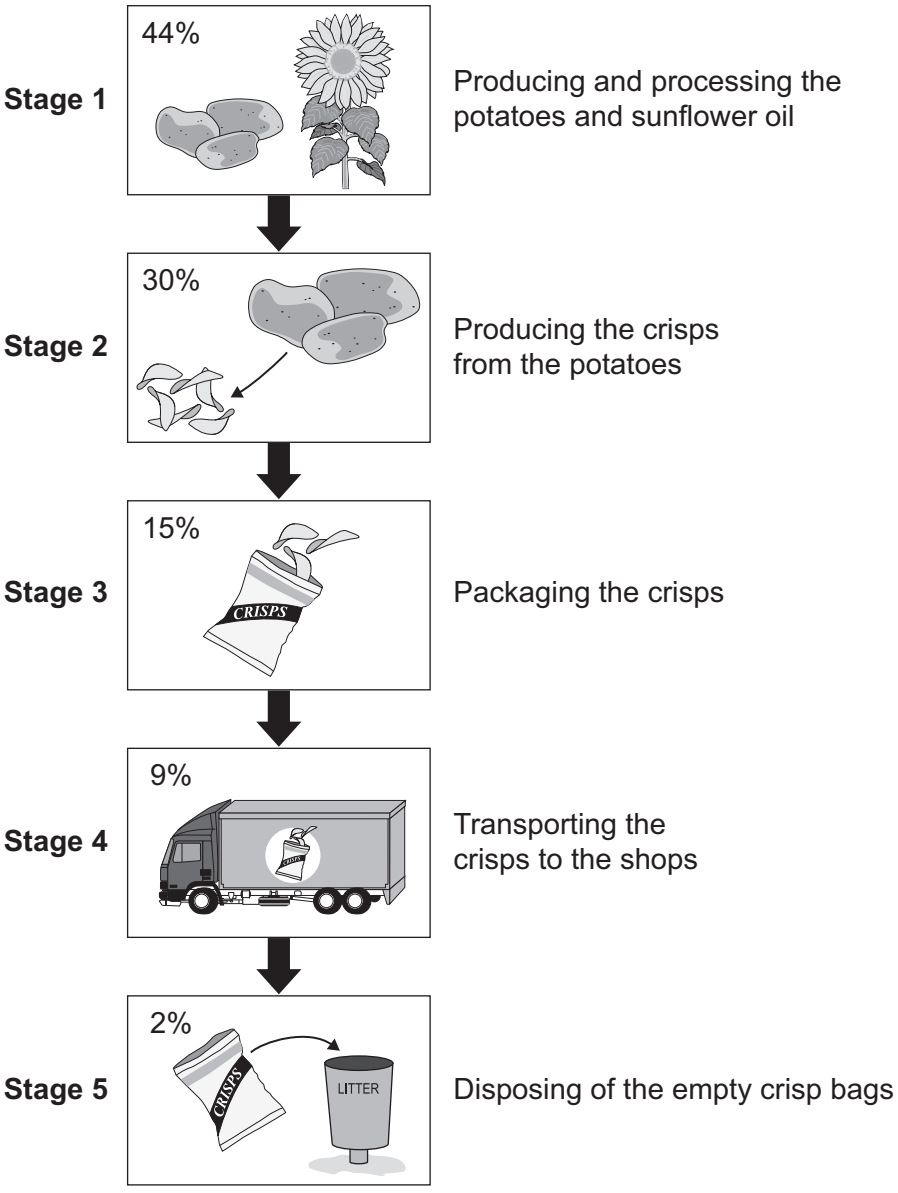
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION SIX

The carbon footprint of a food product is the amount of carbon dioxide produced in its preparation, transportation and disposal.

The diagram shows the percentage (%) of the carbon footprint for each stage for a bag of crisps.



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6A How is most of the carbon dioxide produced in **Stage 4**?

1 It is produced when the lorries use fuel.

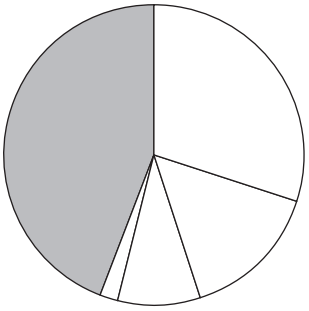
2 It is breathed out by the driver.

3 It escapes from the crisp bags.

4 It escapes from the tyres of the lorries.

6B Which stage on the diagram is shown by the shaded area on the pie chart?

Percentage (%) of carbon footprint for a bag of crisps



1 **Stage 1**

2 **Stage 2**

3 **Stage 3**

4 **Stage 4**

6C If the company reduces the carbon footprint for a bag of crisps, this will help to . . .

1 reduce the acid rain that it causes.

2 meet government targets on global warming.

3 reduce the sale of crisps which contribute to obesity.

4 reduce the use of sunflower oil.

6D Which of the following changes would reduce the carbon footprint for the bag of crisps?

1 increase the sales of the crisps

2 change the colour of the crisp bags

3 pack many more bags of crisps into each lorry

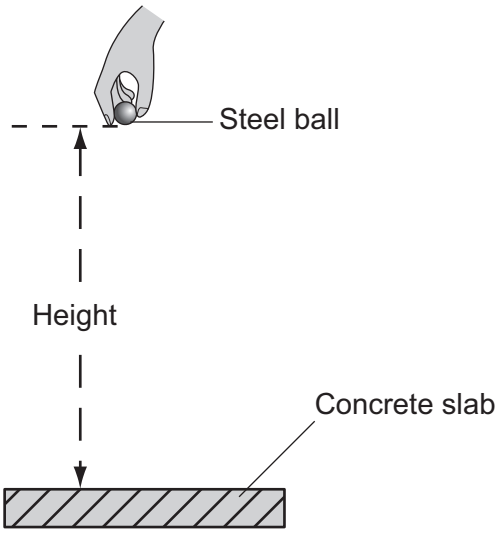
4 increase the number of lorries used for transporting the crisps

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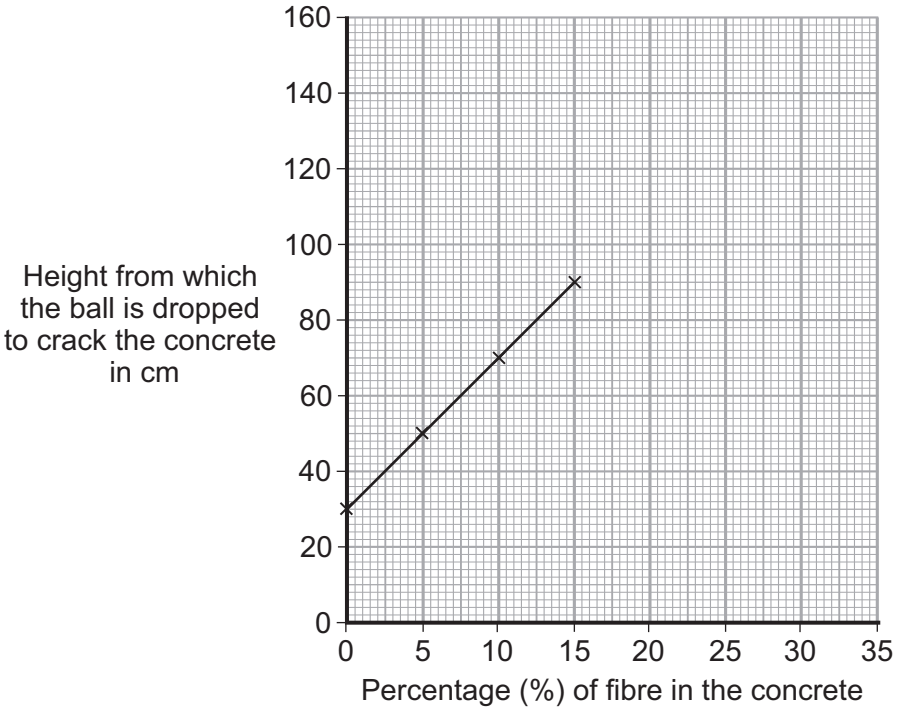
QUESTION SEVEN

Concrete is used as a building material.

A student tests four concrete slabs by dropping a steel ball onto them. The concrete slabs are of equal thickness but contain different amounts of fibre. The student drops the steel ball from increasing heights, until the concrete cracks.



The results are shown on the graph.



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7A The student is testing . . .

1 the composition of the concrete slab.

2 the flexibility of the concrete slab.

3 the hardness of the concrete slab.

4 the thickness of the concrete slab.

7B The student then tests a concrete slab that contains 30% fibre.

From what height do you estimate the ball will need to be dropped to crack this concrete slab?

1 140 cm

2 145 cm

3 150 cm

4 155 cm

7C The dependent variable in this experiment is . . .

1 the percentage of fibre in the concrete slab.

2 the height from which the ball is dropped to crack the concrete slab.

3 the thickness of the concrete slab.

4 the size of the ball.

7D The best conclusion that can be made from the results is that a concrete slab cracks more easily . . .

1 as the size of the slab increases.

2 as the thickness of the slab increases.

3 as the percentage of fibre the slab contains increases.

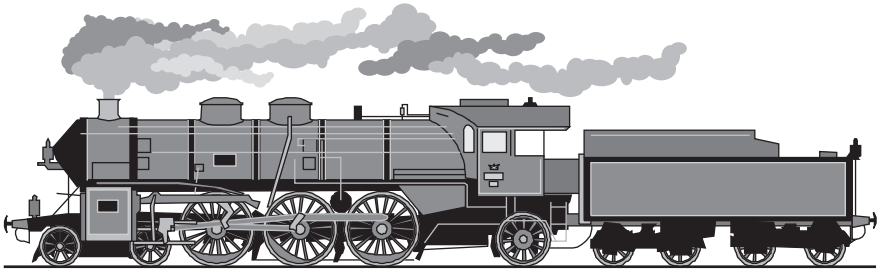
4 as the percentage of fibre the slab contains decreases.

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QUESTION EIGHT

Read the following newspaper extract.

Copper shortage puts the brakes on Flying Scotsman renovation



A major overhaul of the steam locomotive Flying Scotsman has been delayed by more than a year because of a shortage of copper for the engine's firebox.

Copper is at a record high price because of huge demand from China's rapidly growing economy. The price had been falling over the previous 30 years, which had discouraged exploration for new supplies.

Other users of copper have been forced to switch to cheaper materials, with plumbers using plastic rather than copper pipes, and telecoms companies using fibre-optic cables rather than copper wire.

8A The firebox of a steam locomotive is where coal is burned to boil water.

Which of these properties is **not** important when copper is used for the engine's firebox?

1 Copper is a good conductor of heat.

2 Copper has a high melting point.

3 Copper is a good conductor of electricity.

4 Copper is easily hammered and bent into shape.

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8B Which row in the table gives the important properties of copper for plumbers and telecoms companies?

	Plumbers	Telecoms companies
1	High melting point	Good heat conductor
2	Good electrical conductor	High melting point
3	Resistant to corrosion	Good electrical conductor
4	High boiling point	Good electrical conductor

8C Which of the following would make the copper shortage in China and other countries worse?

1 recycling scrap copper rather than burying it in landfill sites

2 developing alternative materials to do the same job as copper

3 extracting copper from low-grade ores

4 forcing suppliers to reduce the price of copper

8D Why is it environmentally important to recycle copper rather than extract copper from its ore?

1 Copper ores are non-renewable, and a lot of energy is needed to extract copper from its ore.

2 There are enormous reserves of copper ore which are not expected to run out for hundreds of years.

3 Copper ores are cheap, and scrap copper is easy to dispose of in landfill sites.

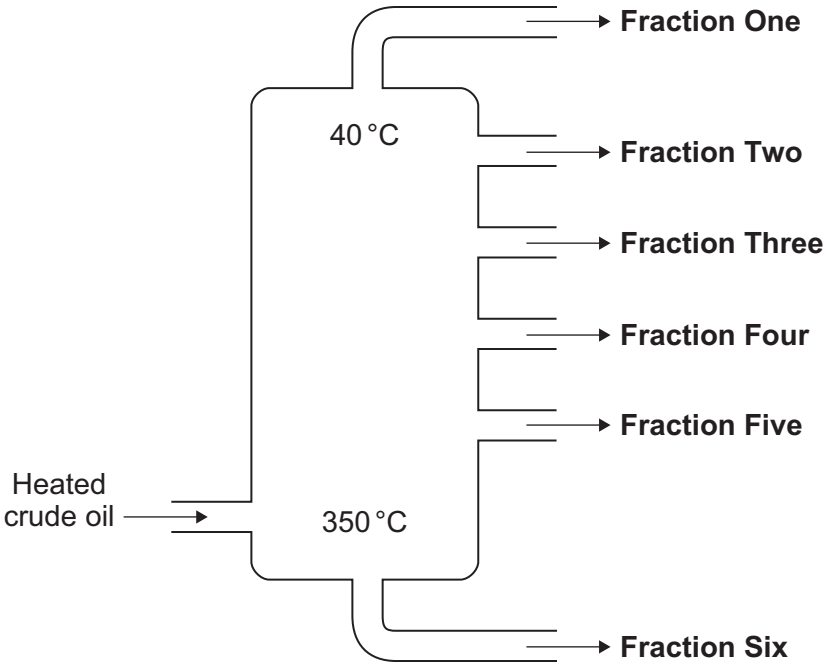
4 Copper recycling is difficult and uses more energy when compared with processing new ores.

Turn over for the next question

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QUESTION NINE

In a fractionating column, crude oil is separated into a number of fractions.



9A Each fraction contains . . .

1 only alkanes that are liquids.

2 only alkanes that condense at temperatures above 40 °C.

3 alkanes with similar boiling points.

4 alkanes with the same chemical formula.

9B Which statement is true for the alkanes in **Fraction One**?

1 They burn to produce carbon dioxide and sulfur dioxide only.

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

3 They are saturated compounds.

4 They are compounds of carbon, hydrogen and oxygen.

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9C When compared with the alkanes in **Fraction Five**, the alkanes in **Fraction Two** . . .

1 will ignite more easily.

2 will be more viscous.

3 will have higher boiling points.

4 will have larger molecules.

9D Propane is an alkane. There are eight hydrogen atoms in one molecule of propane.

The formula for propane is . . .

1 C_2H_8

2 C_3H_8

3 C_4H_8

4 C_3H_8O

END OF TEST

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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**.

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Aluminium atoms and oxygen atoms combine by transferring . . . **2** . . . .

The particles (ions) in aluminium oxide are held together by . . . **3** . . . .

The equation is balanced because, in the reaction, there is no change in the total number of atoms of each of the . . . **4** . . . .

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QUESTION TWO

This question is about the substances in this reaction:

$$Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$$

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

A C

B Fe

C CO

D Fe_2O_3

1	In the reaction, it is reduced.
2	It is a transition element.
3	In the reaction, it is oxidised.
4	It is formed by oxidation of a non-metal element.

Turn over for the next question

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Section Two

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

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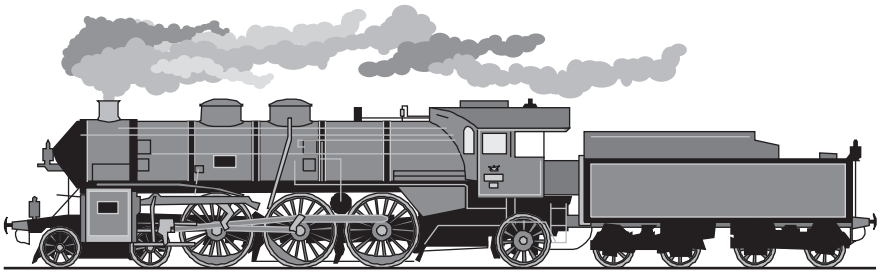
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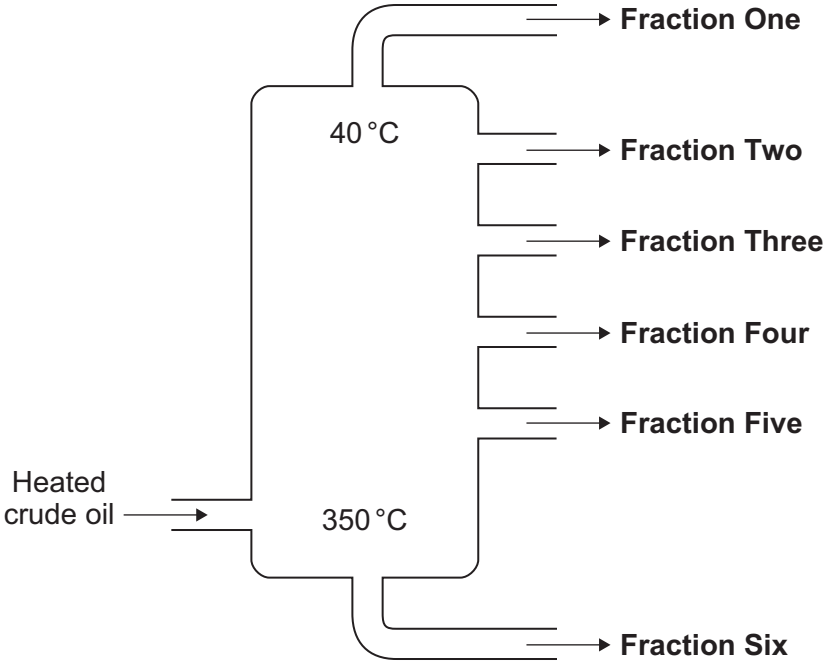
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Turn over for the next question

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QUESTION FOUR

In a fractionating column, crude oil is separated into a number of fractions.



4A Each fraction contains . . .

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3 alkanes with similar boiling points.

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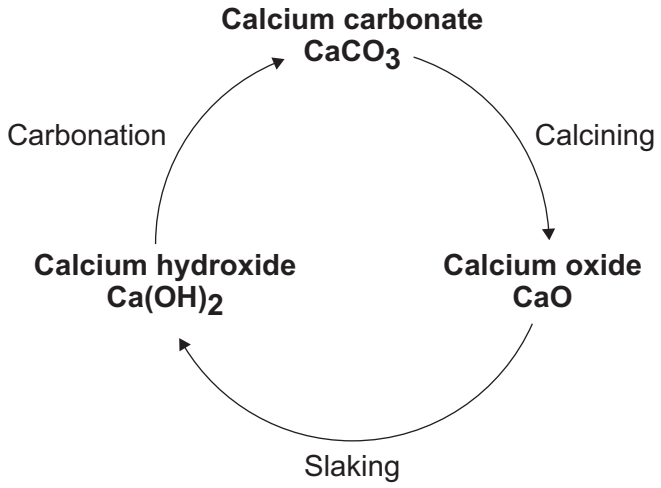
4 C_3H_8O

Turn over for the next question

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QUESTION FIVE

The diagram shows substances and processes in the lime cycle.



The words calcining, slaking and carbonation are used in the lime industry to name the processes in the lime cycle.

5A What type of reaction is described as *calcining* in the diagram?

1 neutralisation

2 thermal decomposition

3 combustion

4 hydration

5B What substance reacts with calcium oxide during *slaking*?

1 carbon dioxide

2 calcium hydroxide

3 hydrogen

4 water

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5C Which of the following is the correct equation for *carbonation*?

1 $Ca(OH)_2 \rightarrow CaCO_3 + H_2O$

2 $CaCO_3 \rightarrow CaO + CO_2$

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

4 $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

5D Which of the following parts of the lime cycle contributes to global warming?

1 calcining only

2 slaking only

3 carbonation only

4 slaking and carbonation

Turn over for the next question

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QUESTION SIX

In 1774, a Frenchman called Antoine Lavoisier put forward this theory:

> "*Matter can neither be created nor destroyed, and in every chemical reaction there is just as much matter present before, as after the reaction has taken place*."

6A This theory is now an accepted law of chemistry.

This law means that in any chemical reaction . . .

1 the mass of the products is equal to the mass of the reactants.

2 new atoms are produced from the atoms which make up the reactants.

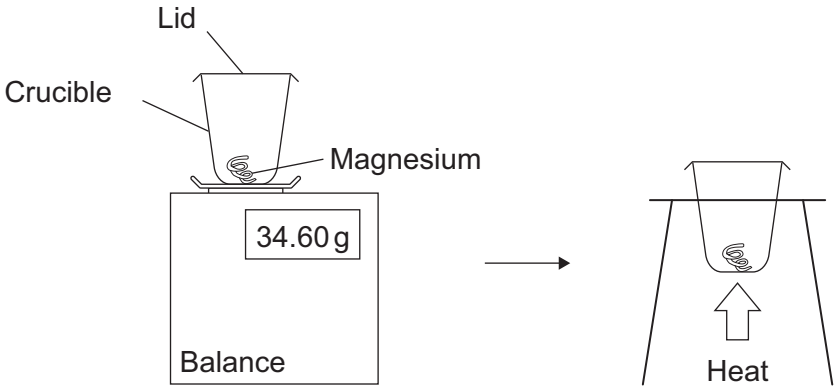
3 the number of molecules of reactants is equal to the number of molecules of products.

4 atoms of elements react by giving, taking or sharing electrons.

A student investigated the reaction when some magnesium burned completely in oxygen.

magnesium + oxygen → magnesium oxide

The student weighed a crucible, its lid and a piece of magnesium.



The student then:

- heated the crucible for one minute, raising the lid occasionally
- allowed the crucible, lid and contents to cool, and then reweighed them
- repeated the heating, cooling and reweighing several times.

The results are shown in the table.

Total time of heating in minutes	0	1	2	3	4	5	6
Mass of crucible, lid and contents in grams	34.60	34.92	35.00	35.07	35.10	35.10	35.10

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6B Which row in the table below correctly explains the procedures in the experiment?

	Reason for:	
	raising the crucible lid occasionally	**repeating the heating, cooling and reweighing**
1	so the crucible would not get too hot	to check the accuracy of the balance
2	to allow air to enter the crucible	to make sure that all the magnesium had reacted
3	to allow air to enter the crucible	to check the accuracy of the balance
4	so the crucible would not get too hot	to make sure that all the magnesium had reacted

6C Why do the results in this experiment appear to contradict Lavoisier's theory?

1 The mass of reacting oxygen was not included in the weighings.

2 Magnesium oxide is a compound but magnesium and oxygen are elements.

3 There was not enough oxygen for all of the magnesium to react.

4 The mass of magnesium used was too small.

6D From calculations done before the experiment, the student expected the final mass of the crucible, lid and contents to be 35.32 grams rather than 35.10 grams.

The best explanation for this difference is that . . .

1 the student did not heat the crucible to a high enough temperature.

2 some magnesium oxide escaped from the crucible.

3 magnesium oxide begins to decompose at the temperature of the Bunsen burner.

4 the student did not allow the crucible to completely cool each time.

Turn over for the next question

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QUESTION SEVEN

This question is about the properties of iron and steel.

7A Production of cast iron from iron ore is an example of . . .

1 distillation.

2 reduction.

3 electrolysis.

4 combustion.

7B 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 layers of atoms can easily slide over each other.

7C 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.

7D 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.

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Turn over for the next question

QUESTION EIGHT

Cars are being developed that use hydrogen as a fuel instead of petrol or diesel. When hydrogen burns, the only product is water. Hydrogen can be used to power fuel cells that produce electricity to run the car, rather than burning hydrogen in a traditional car engine.

Hydrogen can be obtained from water by electrolysis. This method is both expensive and slow, so scientists are trying other methods of producing hydrogen.

A company has developed solar cells that can convert 8% of solar energy into hydrogen. The solar cells must achieve a conversion of 10% before these cells become cost-effective.

8A In the electrolysis of water, the products are hydrogen and . . .

1 oxygen only.

2 oxygen and carbon dioxide.

3 carbon dioxide only.

4 carbon dioxide and nitrogen.

8B One advantage that a hydrogen-powered car that uses fuel cells has over a petrol-powered car is that . . .

1 less sulfur dioxide is produced by the car.

2 it causes only half the global dimming.

3 hydrogen-powered cars need to use solar energy.

4 it is safer because the hydrogen does not burn.

8C Hydrogen-powered cars are **not** common on roads yet because . . .

1 hydrogen resources are scarce.

2 fuel cell technology has been expensive to develop.

3 the only product is water.

4 electrolysis is a slow process.

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A scientist has claimed that there are a number of technical and financial problems with hydrogen-powered cars. He said that the development of hydrogen-powered cars also required development of an economic way to produce hydrogen. He described this by saying, 'there is a chicken and egg issue here'.

8D The statement, 'there is a chicken and egg issue here' made by the scientist means that . . .

1 the technology is basic at the moment but it will develop well by 2020.

2 there is no point producing hydrogen-powered cars if hydrogen fuel is not widely available.

3 people will **not** want to buy the first hydrogen-powered cars because they will be slow.

4 we must develop other fuels before oil runs out.

Turn over for the next question

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QUESTION NINE

This question is about metals.

9A A scientist investigated some reactions of three metals, **K**, **L** and **M**.

- Metal **L** can be extracted by mixing its oxide with carbon and heating.
- Metal **M** cannot be extracted by mixing its oxide with carbon and heating.
- Hydrogen will displace metal **K** from its oxide but will not displace metal **L** from its oxide.
- The oxide of metal **K** is decomposed to the metal on heating alone.

The order of reactivity for the three metals, with the most reactive first, is . . .

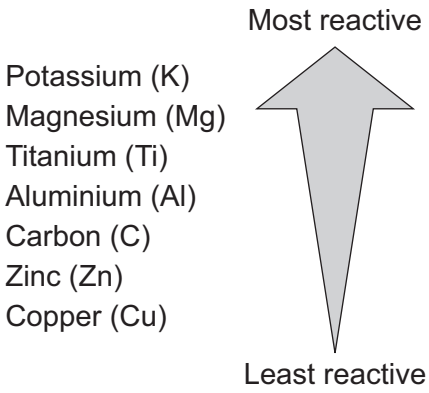
1 **K**, **L**, **M**.

2 **M**, **L**, **K**.

3 **L**, **K**, **M**.

4 **K**, **M**, **L**.

9B The order of reactivity for some metals and carbon is shown below.



Which of the following shows a correctly balanced equation for a possible reaction?

1 $ZnO + C \rightarrow Zn + CO_2$

2 $Cu + MgO \rightarrow CuO + Mg$

3 $2Mg + K_2O \rightarrow 2MgO + 2K$

4 $2Al + 3ZnO \rightarrow 3Zn + Al_2O_3$

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Titanium is extracted from titanium chloride. A mixture of titanium chloride and sodium is heated. The reaction takes place in a furnace above 500 °C.

It 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.

9C Which row in the table correctly describes the reaction for the 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

9D The extraction of iron in a blast furnace is a continuous process.

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

This is because . . .

1 the batch process is completed more quickly.

2 titanium is less reactive than iron.

3 the titanium furnace is not kept at the reaction temperature.

4 titanium chloride is not as pure as iron oxide.

END OF TEST

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There are no questions printed on this page

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GCSE

Science A (4461) / Chemistry (4421)

Specification A

CHY1AP, CH1ASF & CH1ASH

Mark Scheme

2012 Examination – November Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the students' responses.

Further copies of this Mark Scheme are available to download from aqa.org.uk

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GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

November 2012

Foundation Tier

Question	Key				
One	**A**	compounds	**1**		
	B	elements	**2**		
	C	groups	**4**		
	D	properties	**3**		
Two	**A**	carbon	**4**		
	B	carbon monoxide	**3**		
	C	carbon dioxide	**1**		
	D	oxygen	**2**		
Three	**A**	Metal A	**2**		
	B	Metal B	**3**		
	C	Metal C	**1**		
	D	Metal D	**4**		
Four	**A**	Fuel A	**1**		
	B	Fuel B	**4**		
	C	Fuel C	**3**		
	D	Fuel D	**2**		
Five	**A**	electrons	**2**		
	B	bonds	**3**		
	C	products	**1**		
	D	elements	**4**		
	A		**B**	**C**	**D**
Six	**1**		**1**	**2**	**3**
Seven	**3**		**3**	**2**	**4**
Eight	**3**		**3**	**4**	**1**
Nine	**3**		**3**	**1**	**2**

GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

November 2012

Higher Tier

Question	Key		
One	**A**	electrons	**2**
	B	bonds	**3**
	C	products	**1**
	D	elements	**4**
Two	**A**	Substance A	**3**
	B	Substance B	**2**
	C	Substance C	**4**
	D	Substance D	**1**

	A	B	C	D
Three	**3**	**3**	**4**	**1**
Four	**3**	**3**	**1**	**2**
Five	**2**	**4**	**4**	**1**
Six	**1**	**2**	**1**	**2**
Seven	**2**	**4**	**2**	**2**
Eight	**1**	**1**	**2**	**2**
Nine	**2**	**4**	**4**	**3**

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http://www.aqa.org.uk/umsconversion

GCSE SCIENCE

AQA

Unit : CHY1AP **CHEMISTRY UNIT 1A**

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : BG12

06-NOV-12

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions ONE to NINE Choose one response 1 - 4 for each of the parts A - D

QUESTION ONE		1	2	3	4
1A	electrons	○	○	○	○
1B	bonds	○	○	○	○
1C	products	○	○	○	○
1D	elements	○	○	○	○

QUESTION TWO		1	2	3	4
2A	Substance A	○	○	○	○
2B	Substance B	○	○	○	○
2C	Substance C	○	○	○	○
2D	Substance D	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A compounds	○	○	○	○
1B elements	○	○	○	○
1C groups	○	○	○	○
1D properties	○	○	○	○

QUESTION TWO	1	2	3	4
2A carbon	○	○	○	○
2B carbon monoxide	○	○	○	○
2C carbon dioxide	○	○	○	○
2D oxygen	○	○	○	○

QUESTION THREE	1	2	3	4
3A Aluminium	○	○	○	○
3B Iron	○	○	○	○
3C Mercury	○	○	○	○
3D Potassium	○	○	○	○

QUESTION FOUR	1	2	3	4
4A LPG	○	○	○	○
4B Diesel	○	○	○	○
4C Ethanol	○	○	○	○
4D Hydrogen	○	○	○	○

QUESTION FIVE	1	2	3	4
5A electrons	○	○	○	○
5B bonds	○	○	○	○
5C products	○	○	○	○
5D elements	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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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

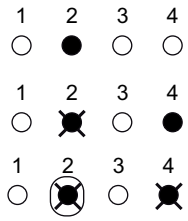
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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

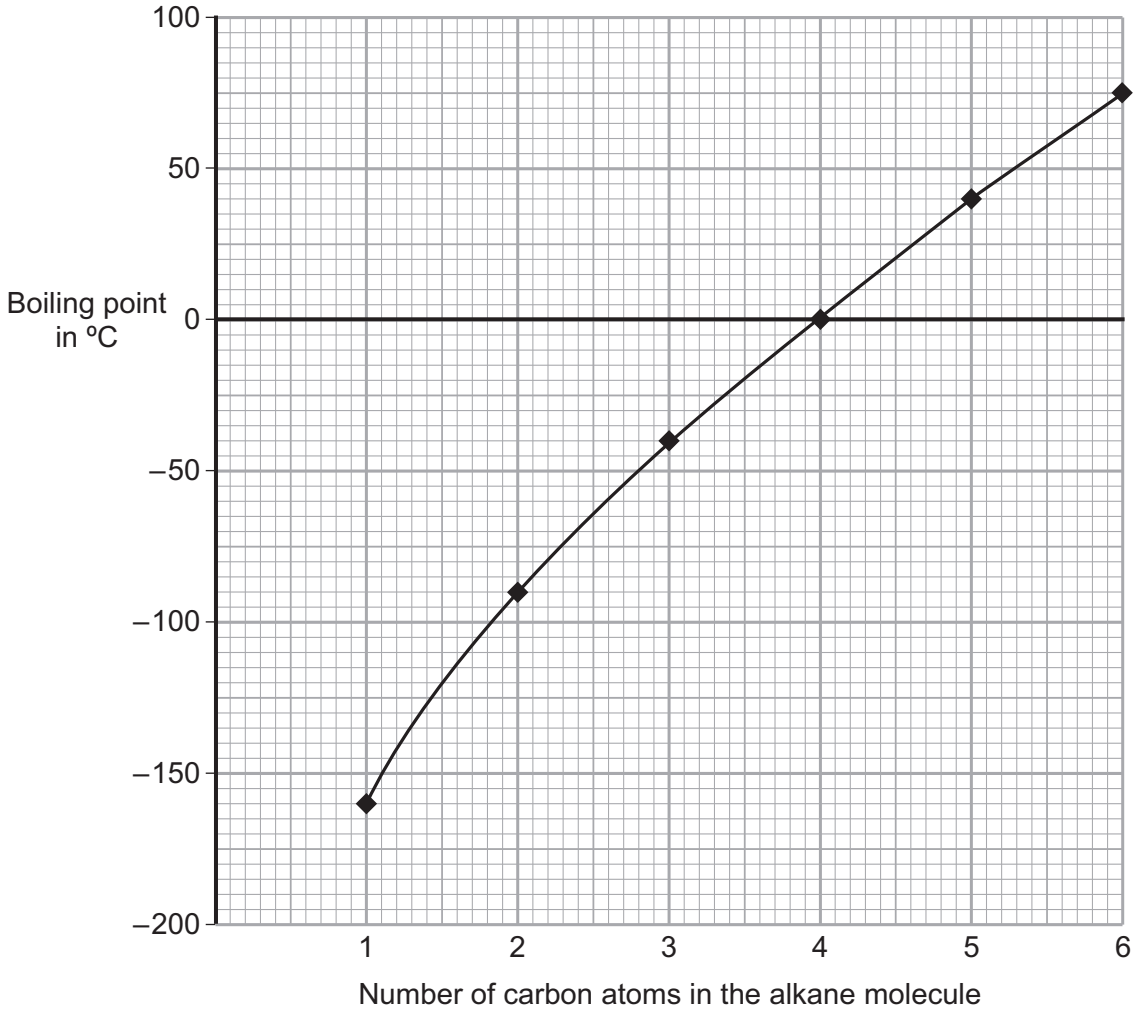
D sodium

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

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QUESTION TWO

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



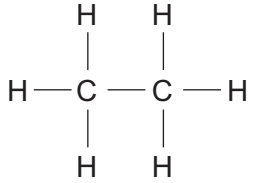
Match values, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the sentences.

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.

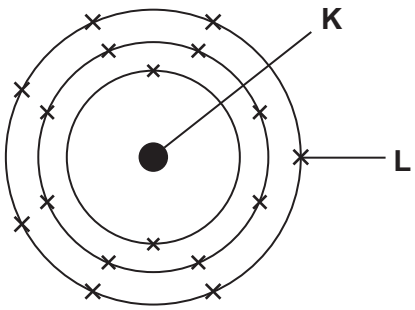
The alkane that is a liquid at 50 °C has . . . **3** . . . carbon atoms in each molecule.

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

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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** . . . .

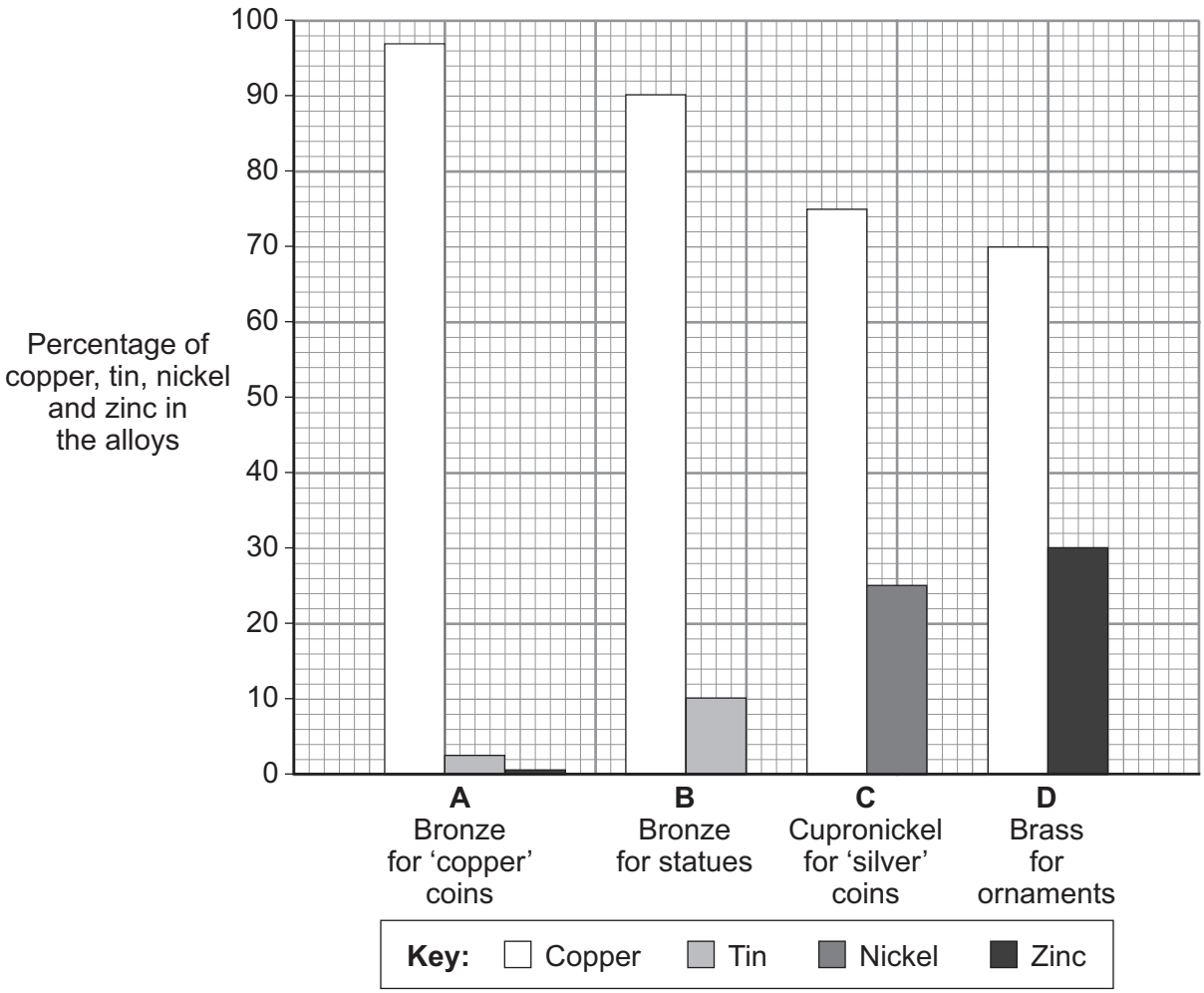
L is . . . **3** . . . .

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

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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

Turn over ▶

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QUESTION FIVE

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

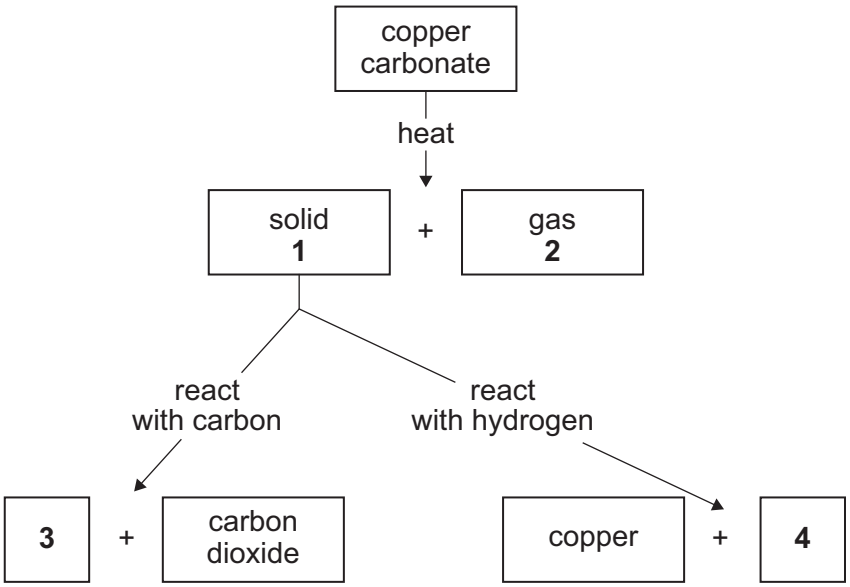
Match substances, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the flow chart.

A carbon dioxide

B copper

C copper oxide

D water



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Turn over for the next question

Section Two

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

Each of these questions has four parts.

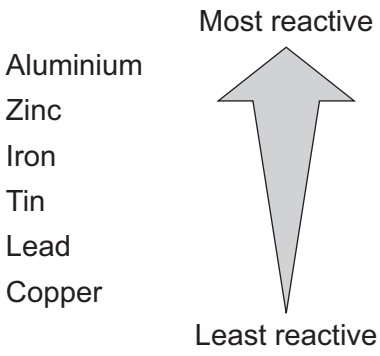
In each part choose only **one** answer.

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.

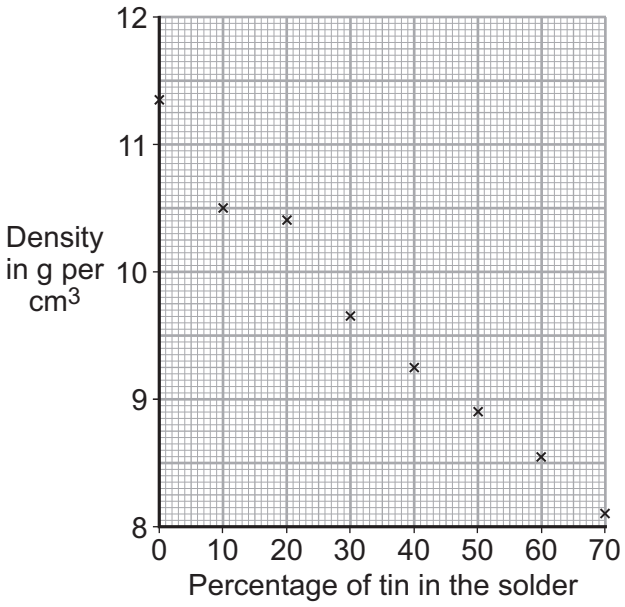
4 tin is stronger than iron.

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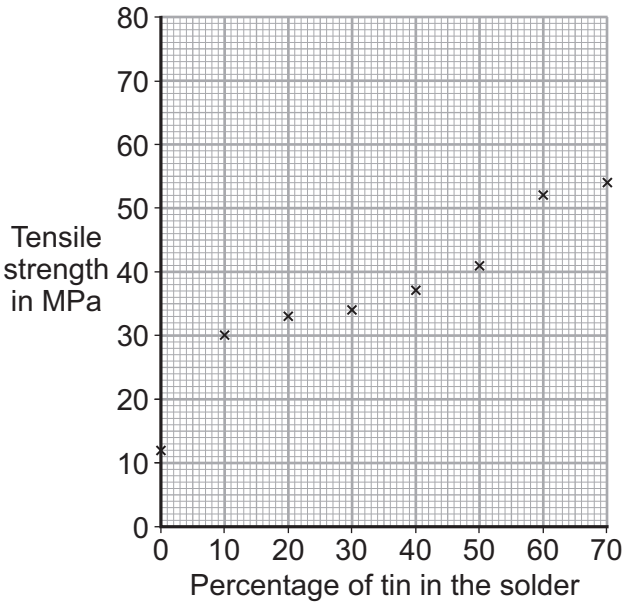
Solder is an alloy of lead and tin.

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.

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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

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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.

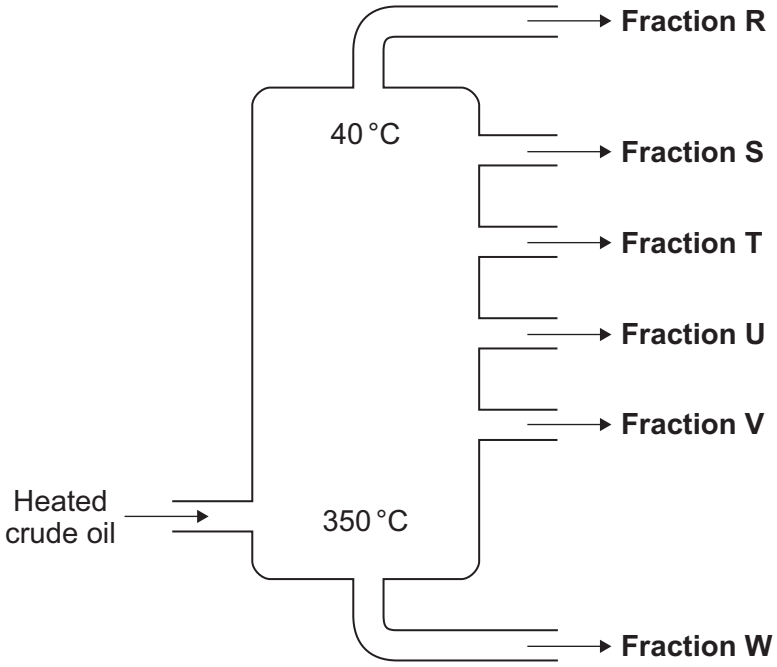
4 did not find the mass of the contents of the tube every 30 seconds.

Turn over for the next question

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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

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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

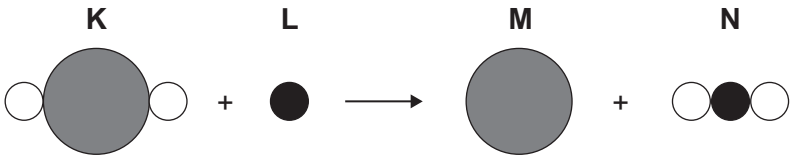
Turn over for the next question

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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.

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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

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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.

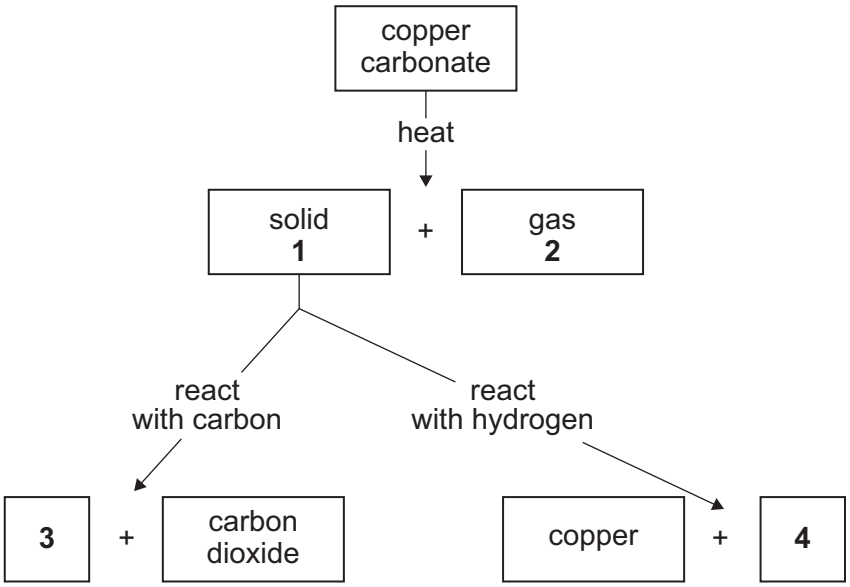
Match substances, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the flow chart.

A carbon dioxide

B copper

C copper oxide

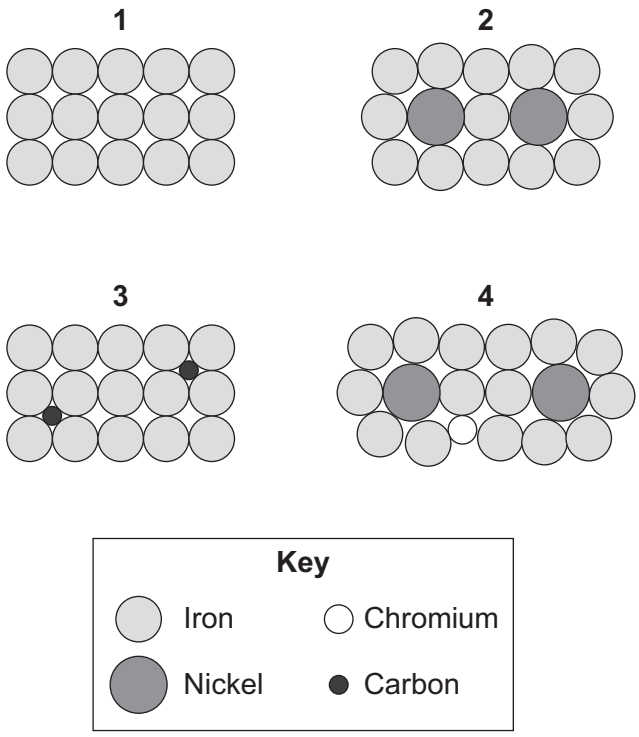
D water



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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

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Section Two

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

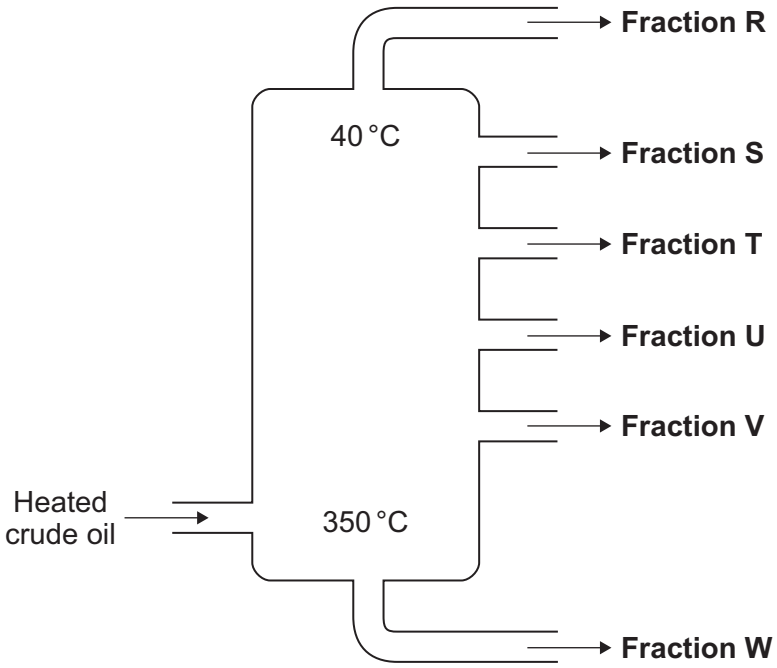
Each of these questions has four parts.

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.

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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

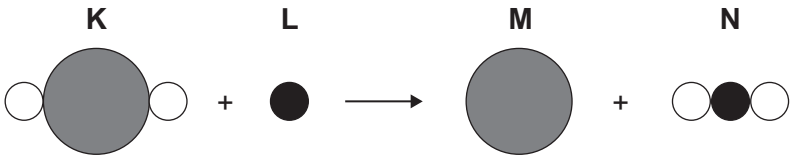
Turn over for the next question

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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.

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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

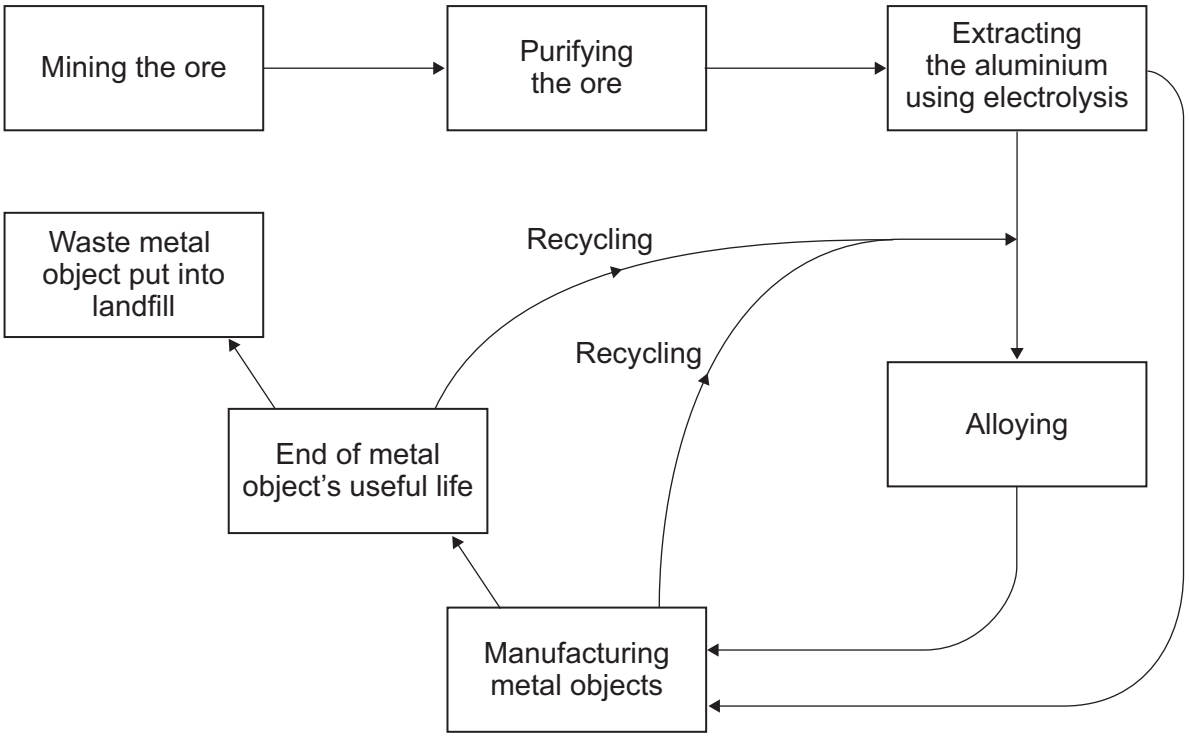
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QUESTION FIVE

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.

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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

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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?

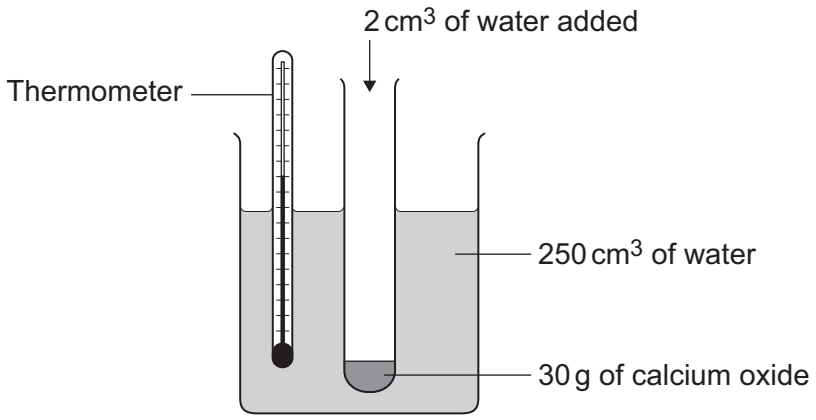
1 $CaO + 2H_2O \rightarrow Ca(OH)_2$

2 $CaO + H_2O \rightarrow CaCO_3 + CO_2$

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

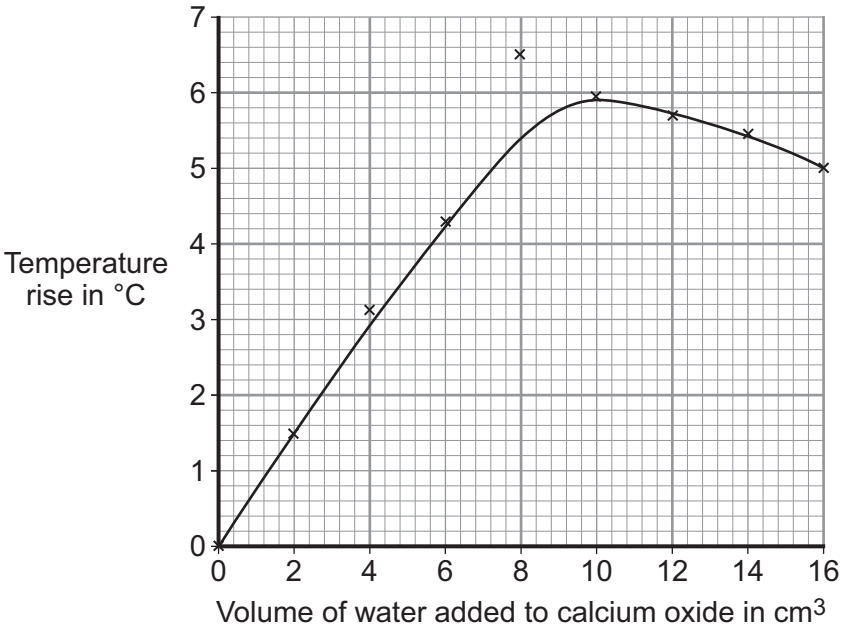
4 $2CaO + H_2O \rightarrow 2Ca(OH)_2$

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.



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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

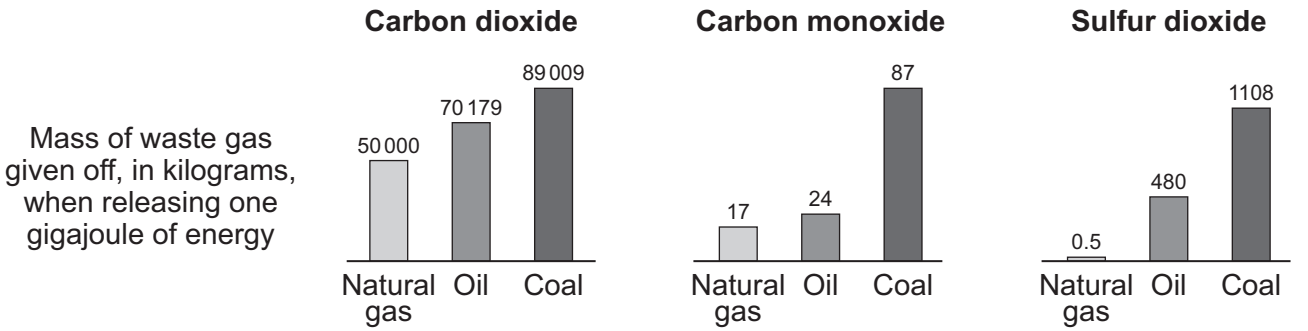
Turn over for the next question

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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.



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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:

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

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

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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

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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

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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.

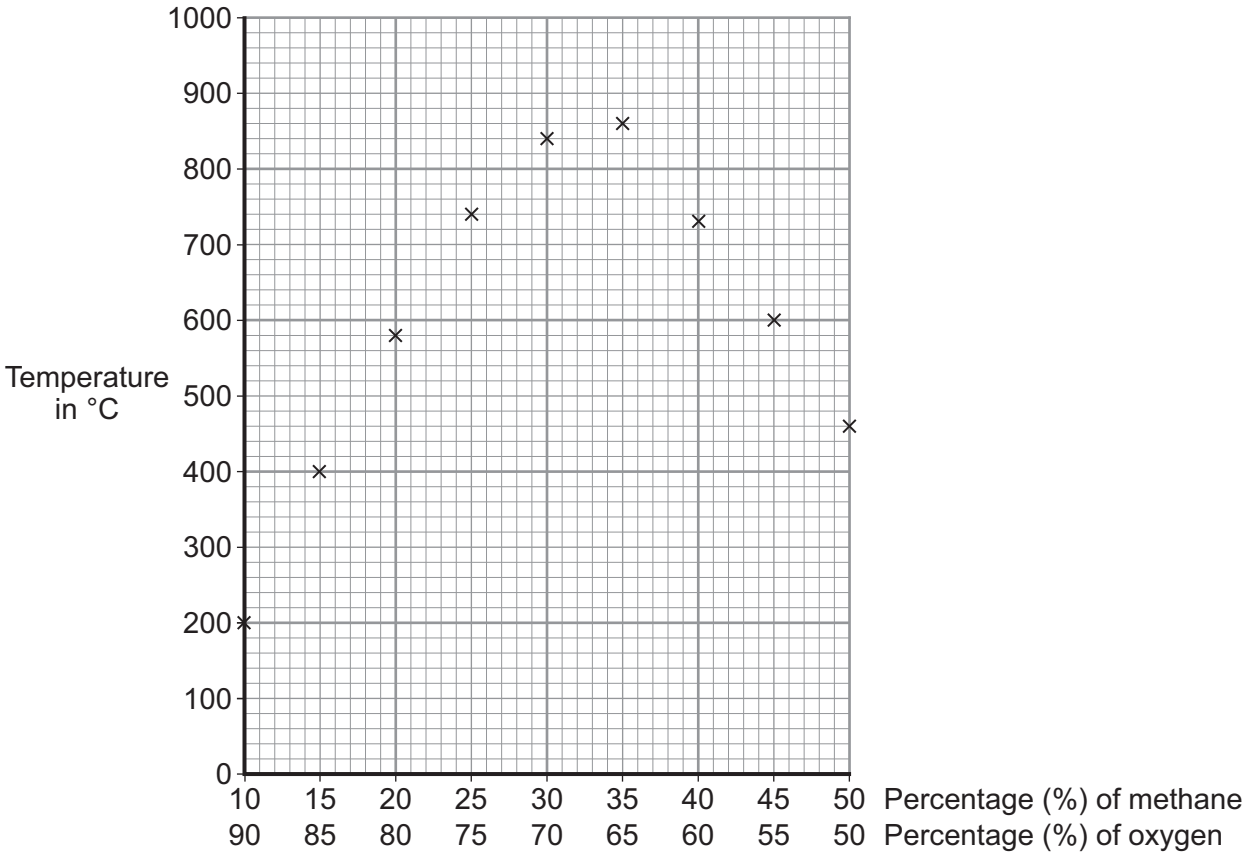
4 titanium chloride is not as pure as iron oxide.

Turn over for the next question

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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.

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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

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There are no questions printed on this page

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GCSE

Science A (4461) / Chemistry (4421)

Specification A

CHY1AP, CH1ASF & CH1ASH

Mark Scheme

2012 Examination – June Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the students' responses.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

June 2012

Foundation Tier

Question	Key		
One	**A**	aluminium	**3**
	B	copper	**2**
	C	iron	**4**
	D	sodium	**1**
Two	**A**	0	**2**
	B	6	**3**
	C	12	**4**
	D	−90	**1**
Three	**A**	the nucleus	**2**
	B	a bond	**4**
	C	an electron	**3**
	D	an element	**1**
Four	**A**	bronze for ‘copper’ coins	**1**
	B	bronze for statues	**4**
	C	cupronickel for ‘silver’ coins	**2**
	D	brass for ornaments	**3**
Five	**A**	carbon dioxide	**2**
	B	copper	**3**
	C	copper oxide	**1**
	D	water	**4**

	A	B	C	D
Six	**3**	**2**	**4**	**4**
Seven	**3**	**2**	**1**	**1**
Eight	**2**	**1**	**4**	**2**
Nine	**3**	**4**	**2**	**3**

GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

June 2012

Higher Tier

Question	Key		
One	**A**	carbon dioxide	**2**
	B	copper	**3**
	C	copper oxide	**1**
	D	water	**4**
Two	**A**	it is probably the softest substance	**1**
	B	it is the alloy that contains only two metals	**2**
	C	it is an alloy that contains only one metal	**3**
	D	it contains the largest number of different elements	**4**

	A	**B**	**C**	**D**
Three	**2**	**1**	**4**	**2**
Four	**3**	**4**	**2**	**3**
Five	**2**	**2**	**3**	**3**
Six	**3**	**2**	**2**	**3**
Seven	**1**	**3**	**2**	**3**
Eight	**2**	**2**	**4**	**3**
Nine	**2**	**3**	**2**	**3**

AQA

Unit : CHY1AP CHEMISTRY UNIT 1A

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 6M12

22-JUN-12

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	carbon dioxide	○	○	○	○
1B	copper	○	○	○	○
1C	copper oxide	○	○	○	○
1D	water	○	○	○	○

QUESTION TWO		1	2	3	4
2A	it is probably the softest substance	○	○	○	○
2B	it is the alloy that contains only two metals	○	○	○	○
2C	it is an alloy that contains only one metal	○	○	○	○
2D	it contains the largest number of different elements	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A aluminium	○	○	○	○
1B copper	○	○	○	○
1C iron	○	○	○	○
1D sodium	○	○	○	○

QUESTION TWO	1	2	3	4
2A 0	○	○	○	○
2B 6	○	○	○	○
2C 12	○	○	○	○
2D -90	○	○	○	○

QUESTION THREE	1	2	3	4
3A the nucleus	○	○	○	○
3B a bond	○	○	○	○
3C an electron	○	○	○	○
3D an element	○	○	○	○

QUESTION FOUR	1	2	3	4
4A bronze for 'copper' coins	○	○	○	○
4B bronze for statues	○	○	○	○
4C cupronickel for 'silver' coins	○	○	○	○
4D brass for ornaments	○	○	○	○

QUESTION FIVE	1	2	3	4
5A carbon dioxide	○	○	○	○
5B copper	○	○	○	○
5C copper oxide	○	○	○	○
5D water	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

Science A

Unit Chemistry C1a (Products from Rocks)

Chemistry

Unit Chemistry C1a (Products from Rocks)

CHY1AP

F&H

Thursday 1 March 2012 Morning Session

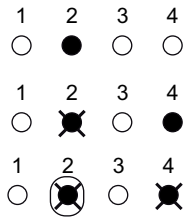
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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 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

The balanced equation shows how the metal calcium reacts with water.

Ca	+	$2H_2O$	→	$Ca(OH)_2$	+	H_2
calcium		water		calcium hydroxide		hydrogen

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

A element

B formula

C molecule

D symbol

In the equation:

calcium is a metallic . . . **1** . . .

O is the . . . **2** . . . for oxygen

H_2 represents one . . . **3** . . . of hydrogen

$Ca(OH)_2$ is the . . . **4** . . . for calcium hydroxide.

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QUESTION TWO

This question is about four elements, **A**, **B**, **C** and **D**.

Element	Melting point in °C	Boiling point in °C	Density in g per cm^3	Electrical conductivity
A	115	444	2.10	poor
B	660	2470	2.70	very good
C	–7	59	3.10	poor
D	98	890	0.97	good

Match elements, **A**, **B**, **C** and **D**, with the sentences **1**–**4** below.

1 It is the metal with the lowest density.

2 It is the non-metal that is a liquid at 20 °C.

3 It is the metal with the highest melting point.

4 It is the non-metal with the highest boiling point.

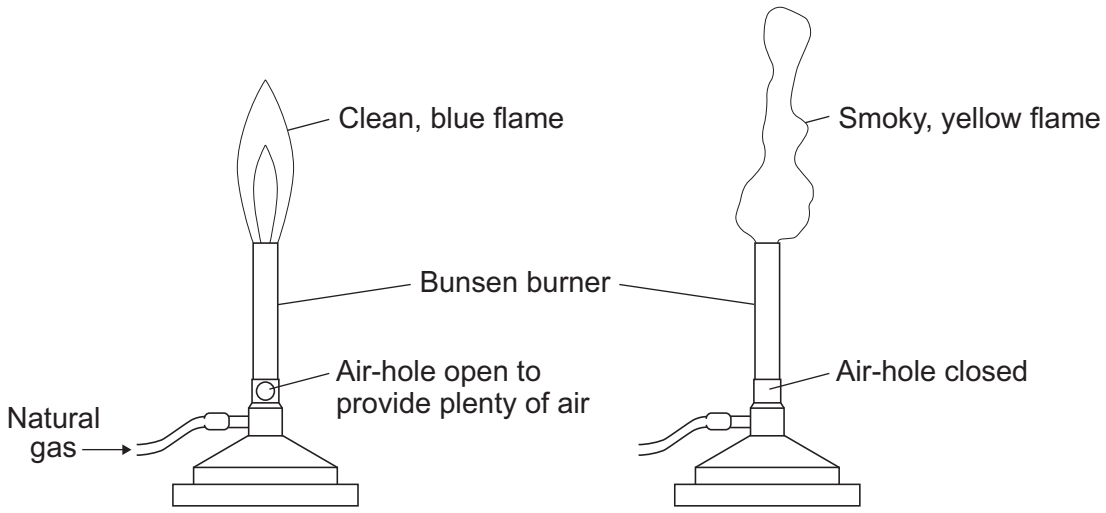
Turn over for the next question

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QUESTION THREE

The diagram shows two different flames that can be produced when natural gas burns.

Natural gas is mainly methane, an alkane.



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

A carbon dioxide

B carbon monoxide

C oxygen

D sulfur dioxide

With the air-hole open, the two main products of combustion are water and . . . **1** . . . .

Water is formed when the hydrogen in methane reacts with . . . **2** . . . .

With the air-hole closed, a different carbon compound that is produced during combustion is . . . **3** . . . .

When natural gas burns, a gas that causes acid rain may be produced.
This gas is . . . **4** . . . .

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QUESTION FOUR

This question is about four metal ores, **A**, **B**, **C** and **D**.

	Name of metal ore	Formula of the metal compound in the ore	Time, in years, before the metal ore is used up
A	Bauxite	Al_2O_3	250
B	Chalcocite	Cu_2S	65
C	Linnaeite	Co_3S_4	100
D	Pentlandite	$NiFeS_2$	55

Key	
Al	Aluminium
O	Oxygen
Cu	Copper
Fe	Iron
Co	Cobalt
S	Sulfur
Ni	Nickel

Match metal ores, **A**, **B**, **C** and **D**, with the sentences **1**–**4** below.

1 It is the ore that will last until about 2077.

2 It is the ore that does not contain a metal sulfide.

3 It is the ore that contains two metals.

4 It is the ore that contains a sulfide of cobalt.

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QUESTION FIVE

This question is about fractional distillation of crude oil.

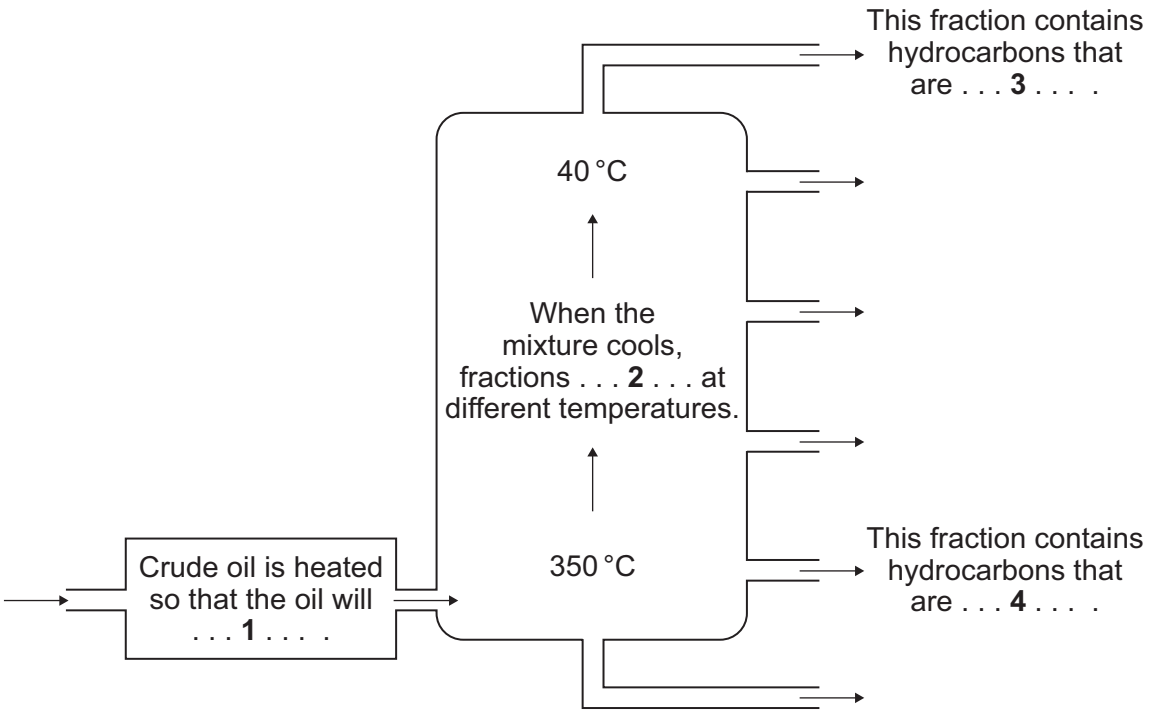
Match words, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the sentences on the diagram.

A condense

B vaporise

C viscous

D volatile



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Turn over for the next question

Section Two

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

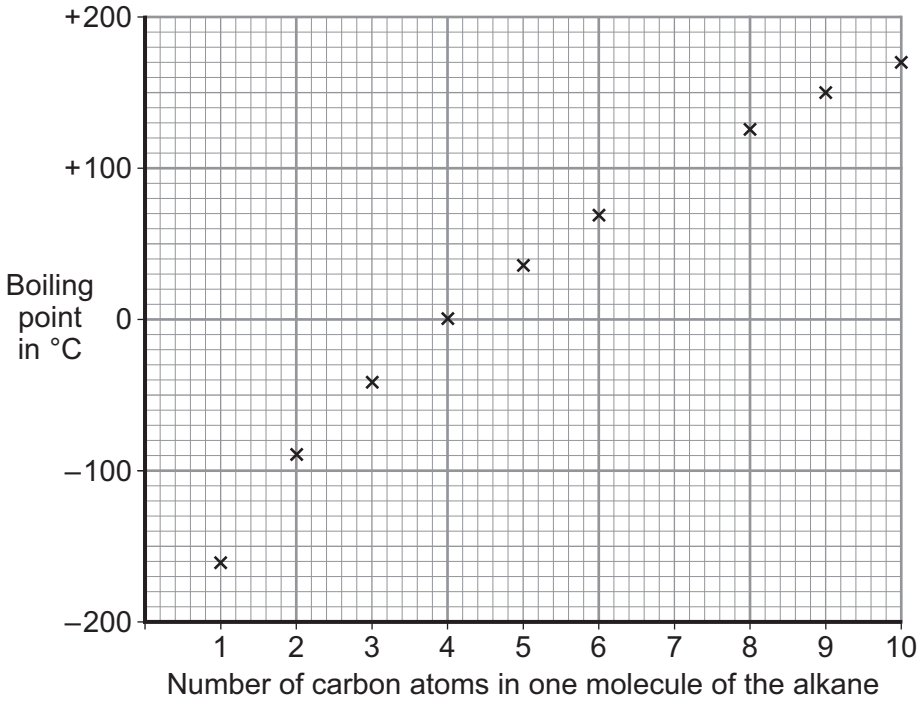
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

The boiling points of nine alkanes are plotted on the graph.



6A The evidence from the graph indicates that . . .

1 the more carbon atoms in the molecule, the lower the boiling point.

2 the boiling point increases as the number of carbon atoms in the molecule increases.

3 the boiling point is directly proportional to the number of carbon atoms in the molecule.

4 the fewer the number of carbon atoms in the molecule, the higher the boiling point.

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6B The alkane with seven carbon atoms in each molecule will have a boiling point of . . .

1 75 °C.

2 100 °C.

3 125 °C.

4 150 °C.

6C The alkanes that are gases at –50 °C are . . .

1 CH_4 and C_2H_6

2 C_2H_6 and C_3H_8

3 in the range C_3H_8 to $C_{10}H_{22}$

4 C_9H_{20} and $C_{10}H_{22}$

6D Compared with the alkane with 10 carbon atoms, the alkane with 2 carbon atoms . . .

1 is more viscous.

2 ignites more easily.

3 burns less easily.

4 burns releasing more carbon particles.

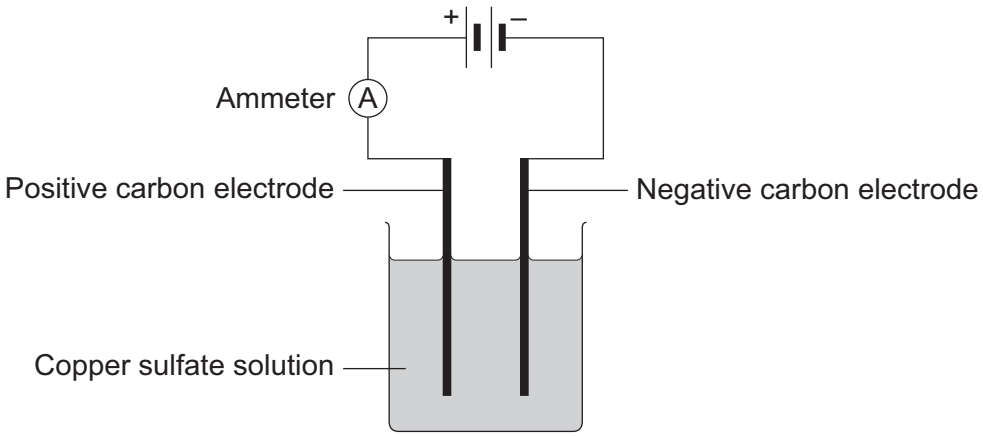
Turn over for the next question

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QUESTION SEVEN

A student investigated the extraction of copper from copper sulfate solution using electrolysis.

The apparatus used is shown in the diagram.



The results are shown in the table.

Current in amps	Time in seconds	Quantity of electricity in coulombs	Mass of copper deposited on the negative electrode in grams
0.5	600	300	0.12
1.0	600	600	0.24
1.5	600	900	0.36
2.0	600	1200	0.48
2.5	600	1500	0.66
3.0	600	1800	0.72

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7A The results are best displayed as a . . .

1 bar chart.

2 scattergram.

3 pie chart.

4 line graph.

7B The mass of copper deposited on the negative electrode for each current was higher than expected.

This is probably because . . .

1 the copper was very pure.

2 the student did not dry the electrode before weighing it.

3 the copper sulfate solution was too dilute.

4 copper quickly evaporates at room temperature.

7C There is an anomalous result for a current of . . .

1 1.0 amps.

2 2.0 amps.

3 2.5 amps.

4 3.0 amps.

7D The pattern in the results indicates that . . .

1 when the quantity of electricity doubles, the mass of copper deposited doubles.

2 the mass of copper deposited does not depend on the time.

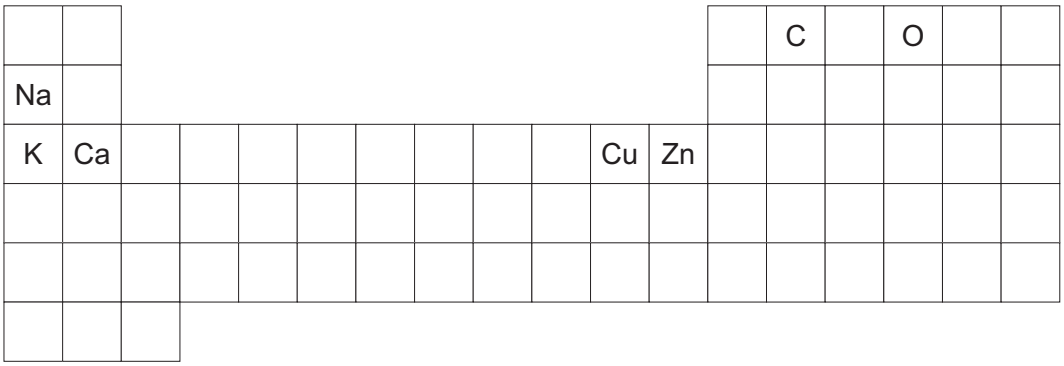
3 the mass of copper deposited does not depend on the current used.

4 when the current doubles, the mass of copper deposited halves.

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QUESTION EIGHT

The diagram shows part of the periodic table.



8A What do the metals copper (Cu) and zinc (Zn) have in common?

1 They are poor heat conductors.

2 They are transition metals.

3 They are in the same group in the periodic table.

4 They both have properties similar to the properties of potassium (K) and calcium (Ca).

8B Copper (Cu) and oxygen (O) are both in the periodic table but copper oxide (CuO) is not.

This is because copper oxide (CuO) is . . .

1 an element.

2 a compound.

3 a mixture.

4 a hydrocarbon.

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8C Which row in the table below correctly shows one similarity **and** one difference between copper and carbon?

	Similarity	Difference
1	Both react with oxygen	Copper is a metal; carbon is a non-metal
2	Both are elements	Copper is a solid; carbon is a gas
3	Both react with oxygen	Copper is a solid; carbon is a gas
4	Both are elements	Copper reacts with oxygen; carbon does not react with oxygen

8D In the Earth's crust:

- copper may be found as the metal itself or as compounds
- calcium is found only as compounds.

This suggests that . . .

1 copper corrodes more easily than calcium.

2 copper is harder than calcium.

3 copper reacts with calcium compounds.

4 copper is less reactive than calcium.

Turn over for the next question

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QUESTION NINE

There are deposits of copper ores in some areas of outstanding natural beauty. Copper ores can be extracted by quarrying.

9A There are groups of people who are against the development of quarries in areas of outstanding natural beauty.

One reason for their objection is likely to be that . . .

1 even more tourists will be attracted to the area.

2 there is not much use for copper in the 21st century.

3 quarries make unsightly scars on the landscape.

4 quarries provide a new habitat for wildlife.

9B There are other groups of people who are in favour of the development of quarries in areas of outstanding natural beauty.

One reason that they are in favour is likely to be that . . .

1 the quarries provide an area for leisure activities.

2 employment opportunities for local people will be improved.

3 local people will be able to buy inexpensive copper products.

4 copper carbonate is used for making jewellery.

Some ores of copper contain copper carbonate.

In an experiment, 1.55 grams of pure copper carbonate was heated in a crucible until the copper carbonate decomposed completely. It was found that 0.55 grams of carbon dioxide was given off and a black powder was left in the crucible.

9C What was the mass of the black powder left in the crucible?

1 0.10 g

2 0.55 g

3 1.00 g

4 2.10 g

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9D What is the black powder?

1 copper

2 copper oxide

3 carbon

4 calcium oxide

END OF TEST

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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 fractional distillation of crude oil.

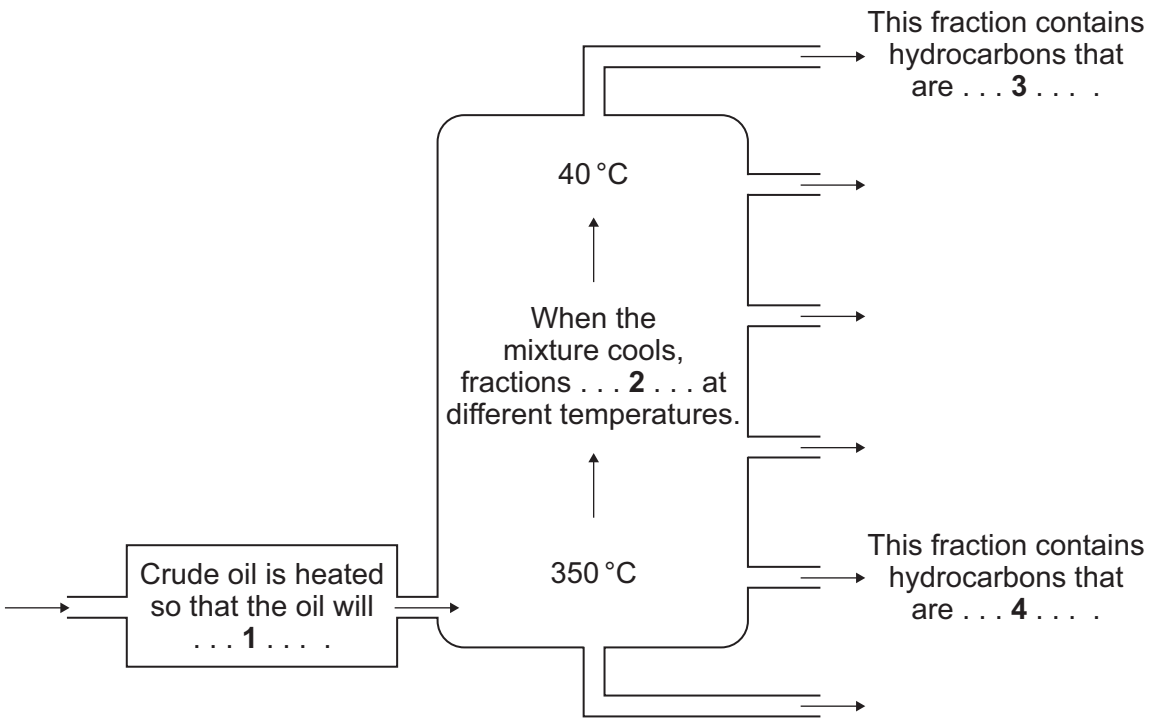
Match words, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the sentences on the diagram.

A condense

B vaporise

C viscous

D volatile



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QUESTION TWO

The balanced equation for a reaction of iron oxide is:

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

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

A carbon dioxide

B carbon monoxide

C iron

D iron oxide

The substance in the equation that is an element is . . . **1** . . . .

The substance in the equation with three molecules, each containing three atoms, is . . . **2** . . . .

The substance that is oxidised in the reaction is . . . **3** . . . .

The substance that is reduced in the reaction is . . . **4** . . . .

Turn over for the next question

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Section Two

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

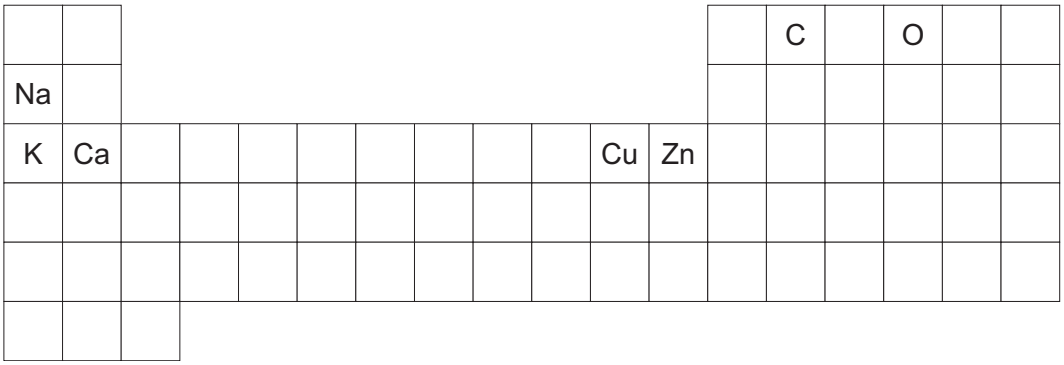
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In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

The diagram shows part of the periodic table.



3A What do the metals copper (Cu) and zinc (Zn) have in common?

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4 They both have properties similar to the properties of potassium (K) and calcium (Ca).

3B Copper (Cu) and oxygen (O) are both in the periodic table but copper oxide (CuO) is not.

This is because copper oxide (CuO) is . . .

1 an element.

2 a compound.

3 a mixture.

4 a hydrocarbon.

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3C Which row in the table below correctly shows one similarity **and** one difference between copper and carbon?

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3D In the Earth's crust:

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- calcium is found only as compounds.

This suggests that . . .

1 copper corrodes more easily than calcium.

2 copper is harder than calcium.

3 copper reacts with calcium compounds.

4 copper is less reactive than calcium.

Turn over for the next question

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QUESTION FOUR

There are deposits of copper ores in some areas of outstanding natural beauty. Copper ores can be extracted by quarrying.

4A There are groups of people who are against the development of quarries in areas of outstanding natural beauty.

One reason for their objection is likely to be that . . .

1 even more tourists will be attracted to the area.

2 there is not much use for copper in the 21st century.

3 quarries make unsightly scars on the landscape.

4 quarries provide a new habitat for wildlife.

4B There are other groups of people who are in favour of the development of quarries in areas of outstanding natural beauty.

One reason that they are in favour is likely to be that . . .

1 the quarries provide an area for leisure activities.

2 employment opportunities for local people will be improved.

3 local people will be able to buy inexpensive copper products.

4 copper carbonate is used for making jewellery.

Some ores of copper contain copper carbonate.

In an experiment, 1.55 grams of pure copper carbonate was heated in a crucible until the copper carbonate decomposed completely. It was found that 0.55 grams of carbon dioxide was given off and a black powder was left in the crucible.

4C What was the mass of the black powder left in the crucible?

1 0.10 g

2 0.55 g

3 1.00 g

4 2.10 g

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4D What is the black powder?

1 copper

2 copper oxide

3 carbon

4 calcium oxide

Turn over for the next question

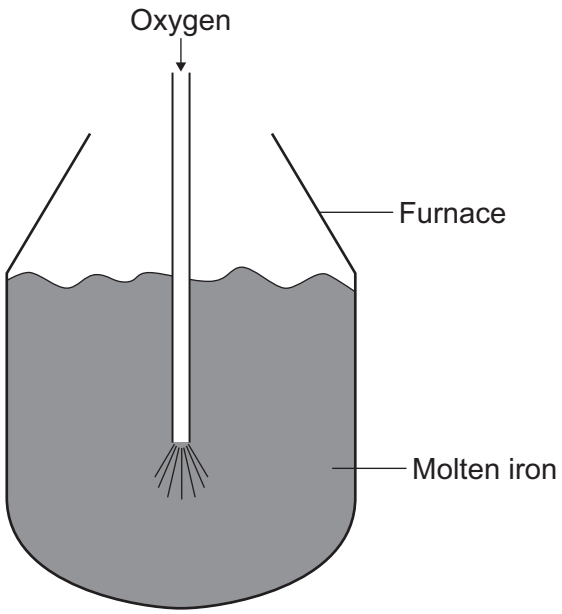
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QUESTION FIVE

The diagrams show two processes for making steel.

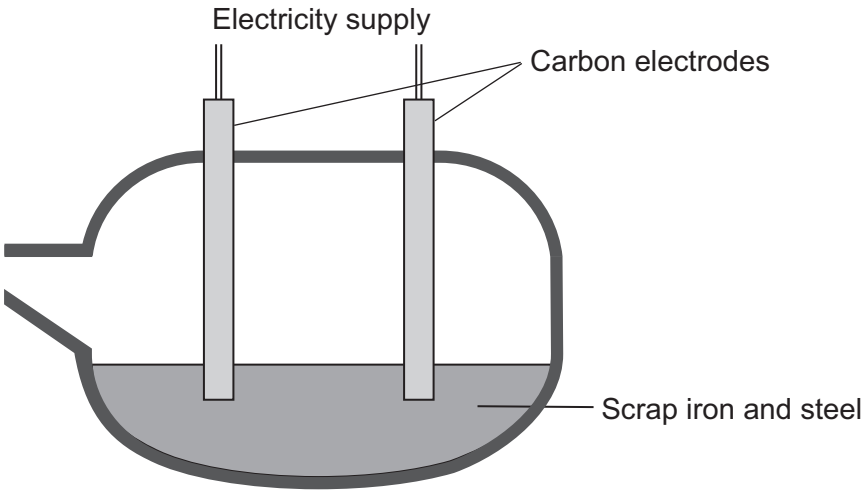
Basic oxygen process

- The furnace contains molten iron from a blast furnace.
- Oxygen is forced into the molten iron.
- The oxygen reacts with the carbon and sulfur impurities.
- The furnace can produce 350 tonnes of steel in 40 minutes.



Electric arc process

- Solid scrap iron and steel are put into the furnace.
- A large electric current melts the scrap iron and steel.
- This furnace can produce 150 tonnes of steel in 4 hours.



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5A In the basic oxygen process, most of the carbon and sulfur impurities are removed from the molten iron.

The impurities leave the furnace as . . .

1 elements.

2 oxides.

3 carbonates and sulfates.

4 liquids.

5B Basic oxygen furnaces are located close to blast furnaces. Electric arc furnaces can be located anywhere.

The main reason why basic oxygen furnaces are located close to blast furnaces is that . . .

1 oxygen is readily available.

2 a trained workforce lives nearby.

3 the basic oxygen furnace uses molten iron.

4 blast furnaces are located near the motorway network.

5C Conversion of iron to steel using the electric arc furnace is more expensive than using the basic oxygen furnace because . . .

1 the electric arc furnace operates at a lower temperature.

2 the electric arc furnace uses large quantities of electricity.

3 iron melts at a higher temperature in the electric arc furnace.

4 most of the scrap iron and scrap steel is sent to landfill.

5D An advantage of using the electric arc furnace compared with the basic oxygen furnace is that . . .

1 the electric arc furnace uses electricity.

2 the rate of production is faster.

3 the carbon electrodes burn to produce carbon dioxide.

4 it will help to conserve iron ore reserves.

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QUESTION SIX

This question is about pentane.

6A Pentane is the fifth member in the alkane series of compounds.

Which of the following could **not** be calculated from this information about the position of pentane in the alkane series?

1 the chemical formula of pentane

2 the number of water molecules produced by burning one molecule of pentane

3 the number of bonds in one molecule of pentane

4 the number of carbon dioxide molecules produced by the incomplete combustion of one molecule of pentane

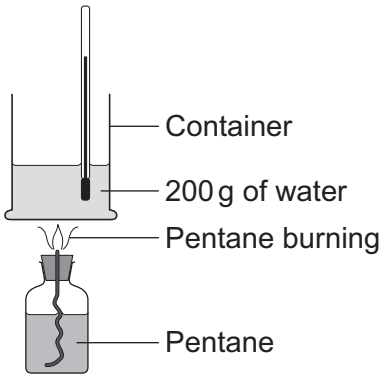
The true value for the energy released when the alkane pentane (C_5H_{12}) burns is 48.6 kJ per gram.

A student used the apparatus in **Figure 1** to check this value.

The student:

- heated 200 grams of water by burning pentane
- recorded the mass of pentane that burned
- recorded the rise in temperature of the water.

Figure 1



From these results, the student calculated the energy released to be 27.9 kJ per gram of pentane.

6B The main reason why this result is different from the true value is that . . .

1 the mass of pentane burned was too large.

2 the mass of water heated was too small.

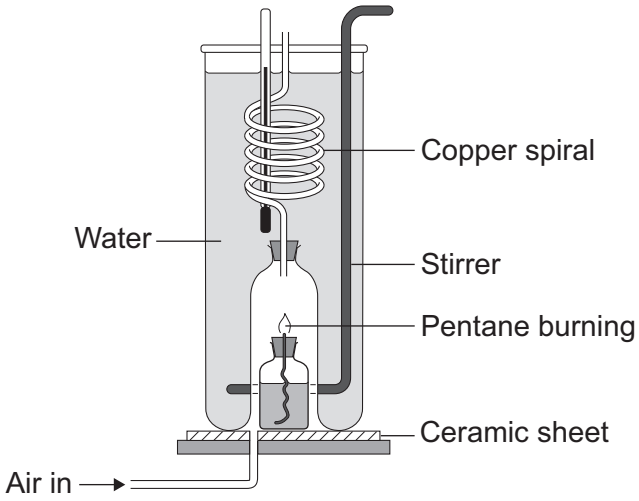
3 the container and surroundings were heated.

4 the thermometer was not directly above the burning pentane.

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The student then used the apparatus shown in **Figure 2** and obtained a result much closer to the true value.

Figure 2



6C This result was more . . .

1 accurate.

2 precise.

3 reliable.

4 systematic.

6D One reason why this result was closer to the true value is that . . .

1 the pentane was burning in a sealed container.

2 the copper spiral has a large surface area.

3 the stirrer was very large.

4 the container for the water in **Figure 2** was made of glass.

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QUESTION SEVEN

The alkanes are a series of compounds.

7A Which of the following changes in the alkane series?

1 the general formula

2 the number of bonds on each carbon atom

3 the ratio of carbon atoms to hydrogen atoms

4 the number of elements present

7B Which of these statements is correct for the alkanes?

1 They all have the general formula C_nH_{2n+1}

2 They are saturated compounds.

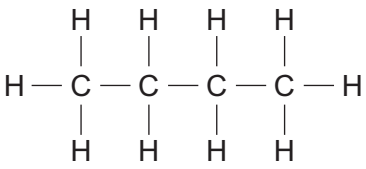
3 Most are gases at room temperature (20 °C).

4 Every carbon atom is bonded to four hydrogen atoms.

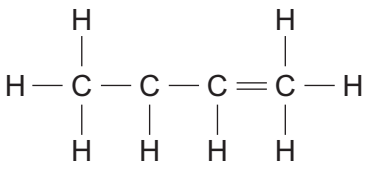
7C Butane is the alkane with four carbon atoms in each molecule.

The structural formula for butane is . . .

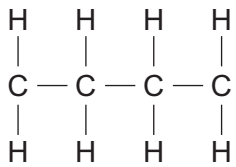
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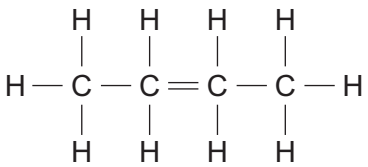
2



3



4



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7D Which of the following represents the equation for the complete combustion of methane?

1 $2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$

2 $CH_4 + O_2 \rightarrow CO_2 + 2H_2$

3 $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

4 $CH_4 + O_2 \rightarrow CO_2 + H_2O$

Turn over for the next question

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QUESTION EIGHT

In June 1783, lava and gases began pouring from a number of volcanoes in Iceland.

An estimated 120 million tonnes of sulfur dioxide was released into the atmosphere. The sulfur dioxide killed a quarter of the population of Iceland.

Sulfur dioxide causes clouds to reflect more sunlight. Some scientists estimate that the sulfur dioxide released in 1783 caused the northern hemisphere to cool by 0.3 °C.

Emissions of sulfur dioxide from human activities increased rapidly through the 20th century to a maximum in 1990, but then gradually decreased as developed countries became more aware of the problems that sulfur dioxide causes.

8A Which row in the table shows two ways in which sulfur dioxide levels in the atmosphere were considerably reduced?

1	increased use of low-sulfur fuels in vehicles	use of hydrogen as a fuel in vehicles
2	a reduction in the number of vehicles	removal of sulfur dioxide from factory waste gases
3	increased use of low-sulfur fuels in vehicles	removal of sulfur dioxide from factory waste gases
4	a reduction in the number of vehicles	use of hydrogen as a fuel in vehicles

8B An increase in the level of sulfur dioxide in the atmosphere will result in . . .

1 less energy entering the atmosphere.

2 more energy entering the atmosphere, but more is then reflected.

3 the same amount of energy entering the atmosphere, but more is then reflected.

4 the same amount of energy reaching the Earth's surface, but less is absorbed.

8C If sulfur dioxide levels continue to decrease, this will . . .

1 reduce the effect of increasing carbon dioxide levels in the atmosphere.

2 have little or no effect on the level of acidity in lakes and rivers.

3 mean there is no need to use low-sulfur fuels.

4 not offset the effects of increasing carbon dioxide levels.

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8D There are different views about future global temperatures.

Which of the following is **not** a valid reason for these different views?

1 The future impact of volcanic activity cannot be predicted.

2 Some evidence may be ignored because of its political significance.

3 The data over the past 150 years show that global temperatures have been increasing.

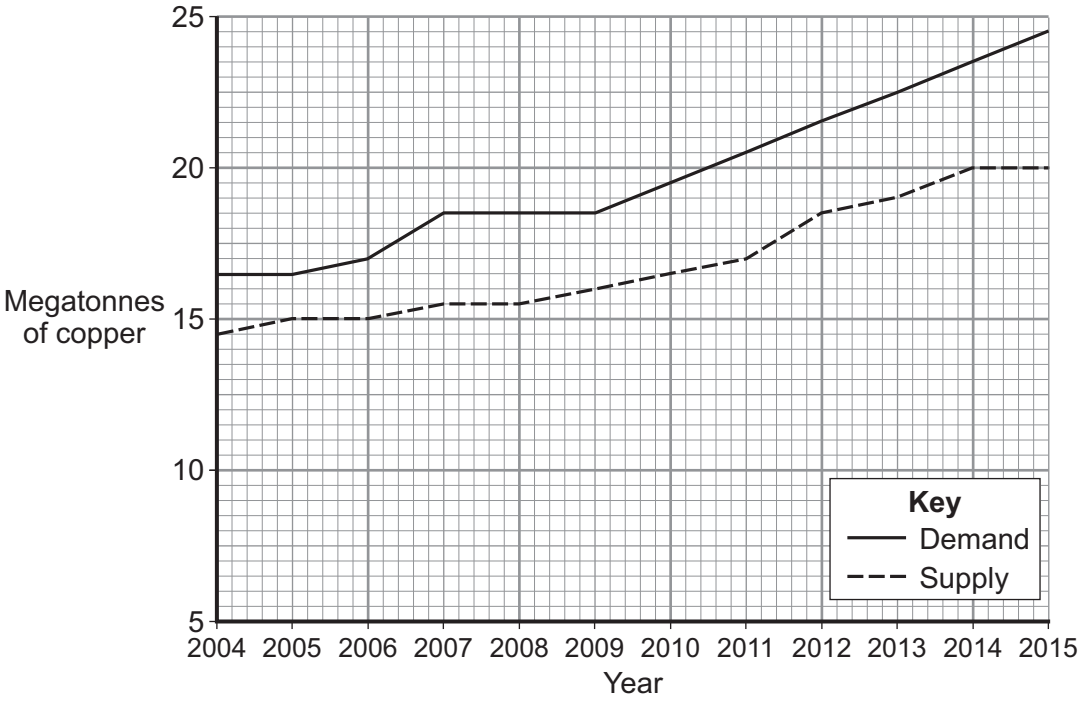
4 Some researchers could be influenced by the company that employs them.

Turn over for the next question

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QUESTION NINE

The graph shows information about the supply of copper and the demand for copper.



9A Between 2007 and 2010, demand for copper increased by about . . .

1 1.0 %.

2 5.4 %.

3 18.5 %.

4 19.5 %.

9B It is estimated that between 2012 and 2015, . . .

1 both supply and demand will increase; supply more than demand.

2 demand will increase by about twice as much as supply.

3 supply will increase by about 3 megatonnes.

4 demand will increase by about 0.5 megatonnes.

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Copper is extracted from high-grade ores by first smelting the mined ore and then purifying by electrolysis.

Copper salts can be extracted from low-grade ores by leaching. Sulfuric acid is run through the ore to produce a solution of copper sulfate. Electrolysis of copper sulfate solution produces copper.

9C One advantage of leaching over smelting is that . . .

1 there are no waste products made during leaching.

2 there is no environmental damage caused by leaching.

3 leaching does not require large quantities of energy.

4 leaching avoids the need to recycle copper.

9D An increase in the use of leaching could occur if . . .

1 the price of copper falls dramatically.

2 deposits of high-grade copper ore become depleted.

3 there is a steady fall in the cost of energy.

4 transport costs decrease.

END OF TEST

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GCSE

Science A (4461) / Chemistry (4421)

Specification A

CHY1AP, CH1ASF & CH1ASH

Mark Scheme

2012 Examination – March Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the students' responses.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

March 2012

Foundation Tier

Question	Key		
One	**A**	element	**1**
	B	formula	**4**
	C	molecule	**3**
	D	symbol	**2**
Two	**A**	Element A	**4**
	B	Element B	**3**
	C	Element C	**2**
	D	Element D	**1**
Three	**A**	carbon dioxide	**1**
	B	carbon monoxide	**3**
	C	oxygen	**2**
	D	sulfur dioxide	**4**
Four	**A**	Bauxite	**2**
	B	Chalcocite	**1**
	C	Linnaeite	**4**
	D	Pentlandite	**3**
Five	**A**	condense	**2**
	B	vaporise	**1**
	C	viscous	**4**
	D	volatile	**3**

	A	B	C	D
Six	**2**	**2**	**1**	**2**
Seven	**4**	**2**	**3**	**1**
Eight	**2**	**2**	**1**	**4**
Nine	**3**	**2**	**3**	**2**

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GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

March 2012

Higher Tier

Question	Key		
One	**A**	condense	**2**
	B	vaporise	**1**
	C	viscous	**4**
	D	volatile	**3**
Two	**A**	carbon dioxide	**2**
	B	carbon monoxide	**3**
	C	iron	**1**
	D	iron oxide	**4**

	A	**B**	**C**	**D**
Three	**2**	**2**	**1**	**4**
Four	**3**	**2**	**3**	**2**
Five	**2**	**3**	**2**	**4**
Six	**4**	**3**	**1**	**2**
Seven	**3**	**2**	**1**	**3**
Eight	**3**	**3**	**4**	**3**
Nine	**2**	**2**	**3**	**2**

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OTQ3

AQA

Unit : CHY1AP **CHEMISTRY UNIT 1A**

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 3G12

01-MAR-12

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	condense	○	○	○	○
1B	vaporise	○	○	○	○
1C	viscous	○	○	○	○
1D	volatile	○	○	○	○

QUESTION TWO		1	2	3	4
2A	carbon dioxide	○	○	○	○
2B	carbon monoxide	○	○	○	○
2C	iron	○	○	○	○
2D	iron oxide	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A element	○	○	○	○
1B formula	○	○	○	○
1C molecule	○	○	○	○
1D symbol	○	○	○	○

QUESTION TWO	1	2	3	4
2A Element A	○	○	○	○
2B Element B	○	○	○	○
2C Element C	○	○	○	○
2D Element D	○	○	○	○

QUESTION THREE	1	2	3	4
3A carbon dioxide	○	○	○	○
3B carbon monoxide	○	○	○	○
3C oxygen	○	○	○	○
3D sulfur dioxide	○	○	○	○

QUESTION FOUR	1	2	3	4
4A Bauxite	○	○	○	○
4B Chalcocite	○	○	○	○
4C Linnaeite	○	○	○	○
4D Pentlandite	○	○	○	○

QUESTION FIVE	1	2	3	4
5A condense	○	○	○	○
5B vaporise	○	○	○	○
5C viscous	○	○	○	○
5D volatile	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
November 2011

Science A

Unit Chemistry C1a (Products from Rocks)

Chemistry

Unit Chemistry C1a (Products from Rocks)

CHY1AP

F&H

Tuesday 15 November 2011 Morning Session

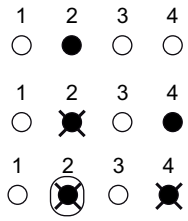
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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 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 iron and steel.

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

A hard

B resistant to corrosion

C easily shaped

D brittle

Iron from the blast furnace has few uses because it is . . . **1** . . . .

Low-carbon steel is used to make car body panels because it is . . . **2** . . . .

High-carbon steel is used to make knives because it is . . . **3** . . . .

Stainless steel is used to make kitchen sinks because it is . . . **4** . . . .

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QUESTION TWO

The table shows information about four copper ores, **A**, **B**, **C** and **D**.

Hardness is measured on a scale of 1 (softest) to 10 (hardest).

	Ore	Density in g per cm^3	Hardness	Formula of the copper compound in the ore	Percentage (%) of copper in the copper compound
A	Chalcocite	5.5–5.7	2.5–3.0	Cu_2S	79.9
B	Chalcopyrite	4.1–4.3	3.5–4.0	$CuFeS_2$	34.5
C	Cuprite	5.8–6.1	3.5–4.0	Cu_2O	88.8
D	Malachite	3.9–4.0	3.5–4.0	$CuCO_3.Cu(OH)_2$	57.3

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

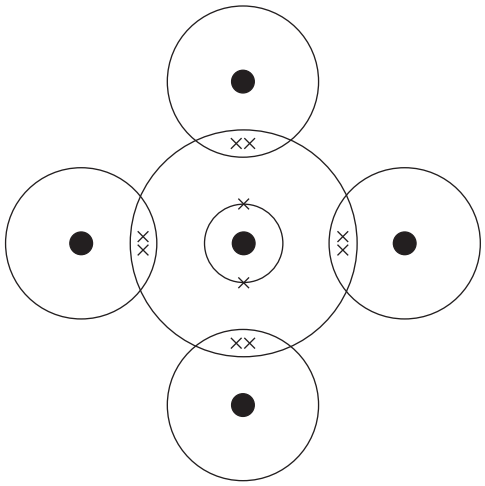
1	It contains the smallest percentage of copper.
2	It is the softest.
3	It has the largest range of density.
4	It has four elements in its formula.

Turn over for the next question

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QUESTION THREE

The diagram shows how a carbon atom can be joined to four atoms of hydrogen to form methane.



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

A a bond

B an electron

C a molecule

D a nucleus

In the diagram, each ● represents . . . **1** . . . and each × represents . . . **2** . . . .

The carbon atom is joined to each hydrogen atom by . . . **3** . . . .

This forms . . . **4** . . . of methane.

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QUESTION FOUR

The table shows some information about four alkanes, **A**, **B**, **C** and **D**.

	Name of alkane	Formula of alkane	Melting point in °C	Boiling point in °C	Amount of oxygen, in cm^3, needed to completely burn 100 cm^3 of the alkane
A	Methane	CH_4	–182	–164	200
B	Ethane	C_2H_6	–183	–89	350
C	Propane	C_3H_8	–190	–42	500
D	Butane	C_4H_{10}	–138	–1	650

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

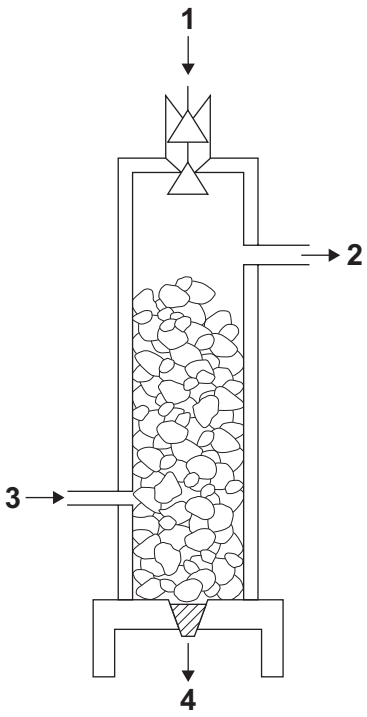
1	This alkane has the lowest melting point.
2	This alkane has the smallest molecules.
3	The boiling point of this alkane is similar to the melting point of ice.
4	10 cm^3 of this alkane requires 35 cm^3 of oxygen to burn completely.

Turn over for the next question

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QUESTION FIVE

The diagram shows a limestone kiln that is used to produce quicklime from limestone.



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

A Carbon dioxide

B Methane and hot air

C Limestone

D Quicklime

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Turn over for the next question

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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

This question is about the viscosity of engine oils.

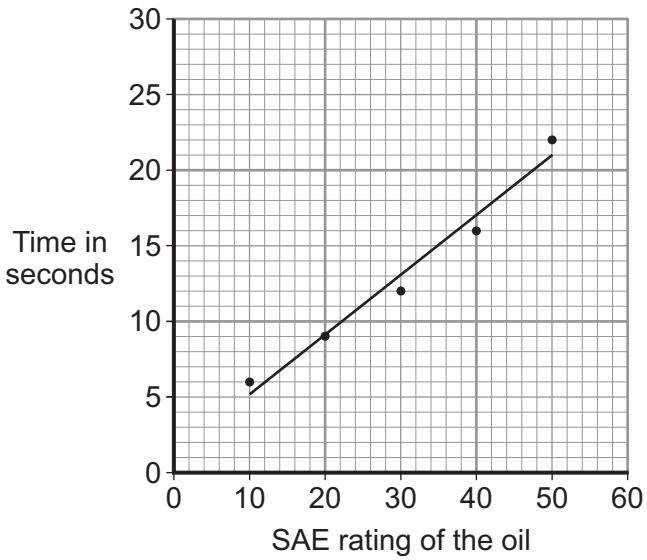
Viscosity is a measure of how easily a liquid will flow.
The less viscous a liquid is, the more easily it will flow.
The viscosities of engine oils are given a rating by the Society of Automotive Engineers (SAE rating).

A student investigated the viscosity of oils with different SAE ratings. She poured a fixed volume of an oil of SAE 10 into a funnel with a narrow spout and started a stopwatch. She measured how long it took for all of the oil to flow out of the funnel.

She repeated the experiment with four different oils.

Here are her results.

SAE rating	Time in seconds
10	6
20	9
30	12
40	16
50	22



6A The experiment shows that . . .

1 an SAE 15 oil would take 15 seconds to flow through the funnel.

2 the SAE 40 oil takes twice as long to flow through the funnel as SAE 20 oil.

3 all five oils have a similar viscosity.

4 viscosity increases as the SAE rating increases.

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6B The reliability of the results could be improved . . .

1 by using a larger funnel.

2 by repeating each test.

3 by using a smaller volume of oil.

4 by using oils with lower SAE ratings.

6C Three months later, the student did the same experiment in the same laboratory, using samples of the same oils.

She found that all the oils took longer to flow through the funnel.

This could be because . . .

1 long oil molecules break into shorter ones when they are stored.

2 the laboratory was at a lower temperature.

3 she had used a funnel with a wider spout.

4 she started the stopwatch only when the oil started to drip out.

6D The student was unsure about the trend shown by the line of best fit through her points.

This is because . . .

1 a curve passing through all the points is always better than a straight line.

2 the points on her graph were plotted incorrectly.

3 none of the points lies on the line.

4 she did not have enough oils to show whether the line should be curved or straight.

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QUESTION SEVEN

National Parks are large, attractive areas where people can enjoy the countryside.

In one particular National Park, a company has a large limestone quarry and a cement factory close to it. There is a village about one kilometre from the cement factory.

7A Although the quarry is a scar on the landscape and increases pollution in the area, local people gain some benefit because . . .

1 it provides a new recreational area.

2 it creates a new habitat for wildlife.

3 it provides employment.

4 it attracts tourists to the area.

7B The main advantage to the company of having a cement factory close to the quarry rather than many kilometres away is that . . .

1 the factory can be operated 365 days a year.

2 transport costs will be less.

3 visual pollution near the village will be minimised.

4 there will be less atmospheric pollution near the village.

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Local people are concerned that a different fuel being used at the cement factory is releasing sulfur dioxide when it is burned.

The table shows the sulfur dioxide concentration in the atmosphere, recorded on one day.

Distance from the cement factory in metres	Concentration of sulfur dioxide in parts per million
0	65
500	48
1000	16
1500	10
2000	5

7C The conclusion from these results is that . . .

1 as the distance in metres doubles, the concentration of the sulfur dioxide is halved.

2 the concentration of sulfur dioxide is lower further away from the cement factory.

3 children should not play within 1000 metres of the cement factory.

4 there is no sulfur dioxide 4000 metres from the cement factory.

7D On another day later in the year, the sulfur dioxide concentrations in the atmosphere were measured at the same places.

The concentrations were much lower.

Which of the following is the most likely reason for this change?

1 an increase in wind speed

2 an increase in cement production

3 the factory using a fuel with a higher sulfur content

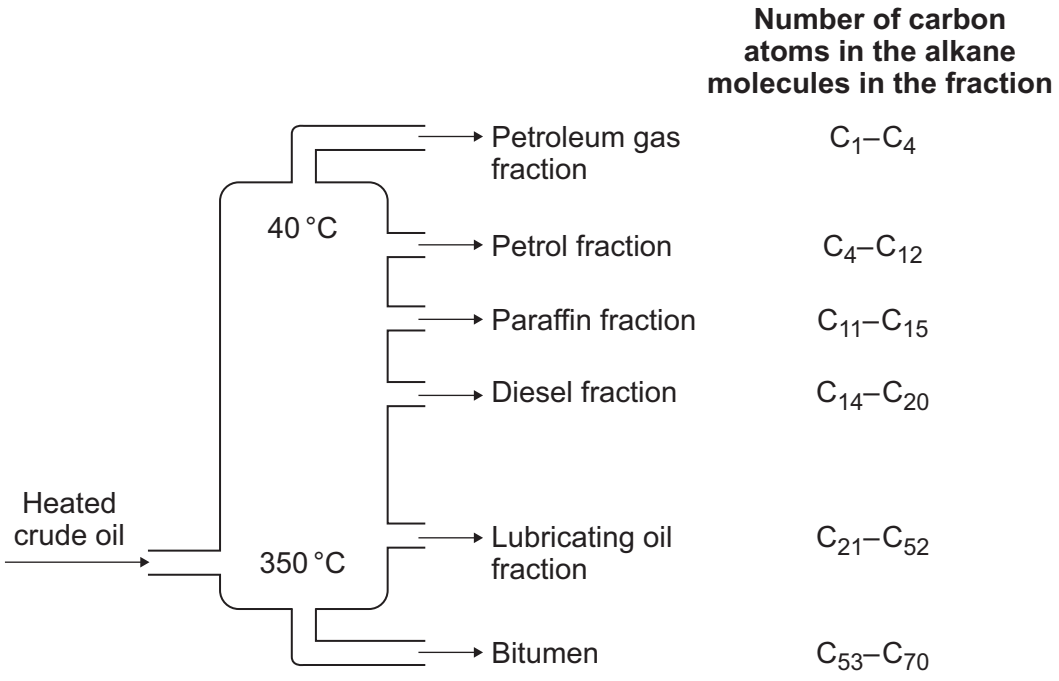
4 less rain when measurements were taken

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QUESTION EIGHT

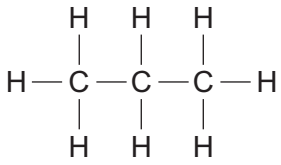
Crude oil can be separated into fractions.

Each fraction contains several alkanes.

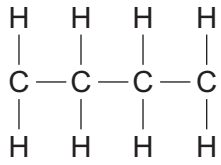


8A One of the alkanes in the petrol fraction can be represented by . . .

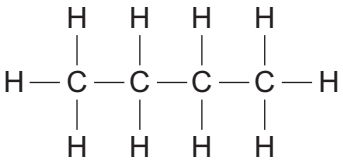
1



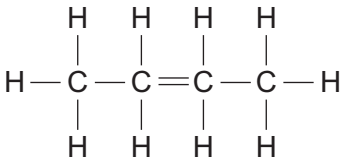
2



3



4



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8B When compared with the alkanes in the petrol fraction, the alkanes in the lubricating oil fraction . . .

1 will be more difficult to ignite.

2 will burn with a cleaner flame.

3 will have lower boiling points.

4 will have smaller molecules.

8C The alkane called nonane has 20 hydrogen atoms in each molecule.

In which fraction will it be mainly collected?

1 Petroleum gas fraction

2 Petrol fraction

3 Diesel fraction

4 Lubricating oil fraction

8D Which of these gases **cannot** be produced when a pure alkane burns?

1 carbon monoxide

2 carbon dioxide

3 sulfur dioxide

4 water vapour

Turn over for the next question

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QUESTION NINE

Iron oxide can be reduced to iron by mixing the oxide with carbon and heating strongly.

Aluminium oxide cannot be reduced to aluminium in this way. Aluminium is obtained from aluminium oxide by electrolysis.

9A Why is it possible to obtain iron but not aluminium by carbon reduction?

1 Iron is more reactive than aluminium.

2 Carbon is more reactive than aluminium but less reactive than iron.

3 Carbon is more reactive than iron but less reactive than aluminium.

4 Aluminium and iron are both more reactive than carbon.

9B The extraction of aluminium by electrolysis is an expensive process because . . .

1 aluminium easily corrodes in air.

2 a large amount of energy is needed.

3 aluminium oxide is difficult to mine.

4 aluminium reacts with carbon.

9C As electrolysis is expensive, an increasing amount of aluminium is being recycled.

Another important reason to recycle aluminium is that . . .

1 it saves limited aluminium oxide reserves.

2 the recycled aluminium is purer.

3 aluminium scrap does not corrode easily.

4 recycling aluminium does not use energy.

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9D Which two of the following statements could explain why aluminium is preferred to iron for making cans for drinks?

W Aluminium has a lower density than iron.

X Aluminium is a better conductor than iron.

Y Aluminium corrodes less easily than iron.

Z Aluminium is not as strong as iron.

1 **W** and **X**

2 **W** and **Y**

3 **X** and **Y**

4 **Y** and **Z**

END OF TEST

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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**.

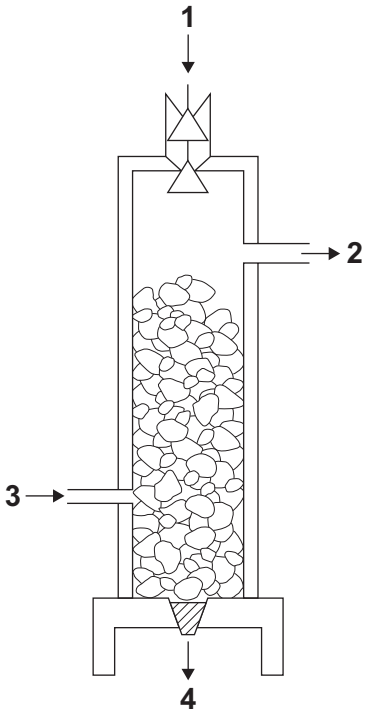
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows a limestone kiln that is used to produce quicklime from limestone.



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

A Carbon dioxide

B Methane and hot air

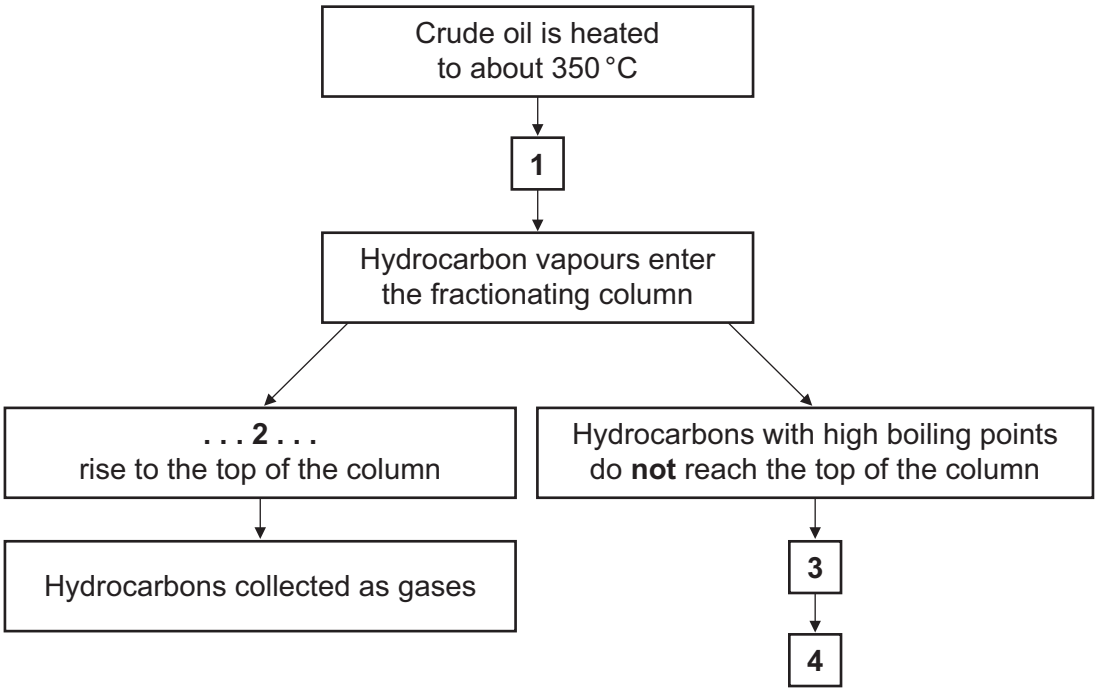
C Limestone

D Quicklime

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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 turn to vapour

B Hydrocarbons cool

C Hydrocarbons with low boiling points

D Hydrocarbons condense to form liquids

Turn over for the next question

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Section Two

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

Each of these questions has four parts.

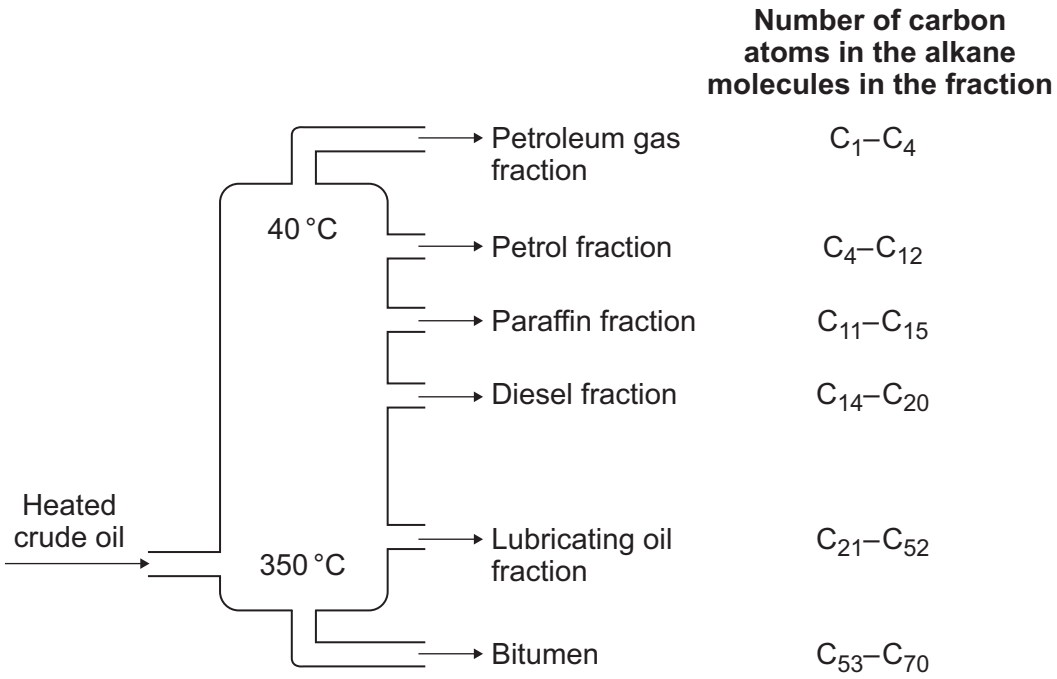
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

Crude oil can be separated into fractions.

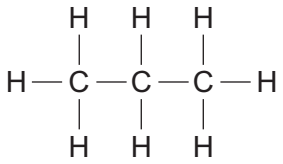
Each fraction contains several alkanes.



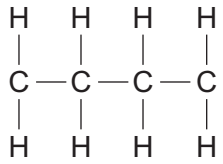
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3A One of the alkanes in the petrol fraction can be represented by . . .

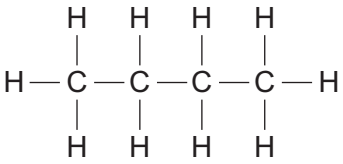
1



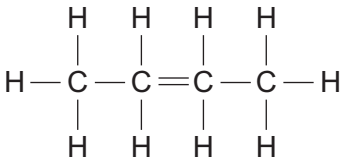
2



3



4



3B When compared with the alkanes in the petrol fraction, the alkanes in the lubricating oil fraction . . .

1 will be more difficult to ignite.

2 will burn with a cleaner flame.

3 will have lower boiling points.

4 will have smaller molecules.

3C The alkane called nonane has 20 hydrogen atoms in each molecule.

In which fraction will it be mainly collected?

1 Petroleum gas fraction

2 Petrol fraction

3 Diesel fraction

4 Lubricating oil fraction

3D Which of these gases **cannot** be produced when a pure alkane burns?

1 carbon monoxide

2 carbon dioxide

3 sulfur dioxide

4 water vapour

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QUESTION FOUR

Iron oxide can be reduced to iron by mixing the oxide with carbon and heating strongly.

Aluminium oxide cannot be reduced to aluminium in this way. Aluminium is obtained from aluminium oxide by electrolysis.

4A Why is it possible to obtain iron but not aluminium by carbon reduction?

1 Iron is more reactive than aluminium.

2 Carbon is more reactive than aluminium but less reactive than iron.

3 Carbon is more reactive than iron but less reactive than aluminium.

4 Aluminium and iron are both more reactive than carbon.

4B The extraction of aluminium by electrolysis is an expensive process because . . .

1 aluminium easily corrodes in air.

2 a large amount of energy is needed.

3 aluminium oxide is difficult to mine.

4 aluminium reacts with carbon.

4C As electrolysis is expensive, an increasing amount of aluminium is being recycled.

Another important reason to recycle aluminium is that . . .

1 it saves limited aluminium oxide reserves.

2 the recycled aluminium is purer.

3 aluminium scrap does not corrode easily.

4 recycling aluminium does not use energy.

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4D Which two of the following statements could explain why aluminium is preferred to iron for making cans for drinks?

W Aluminium has a lower density than iron.

X Aluminium is a better conductor than iron.

Y Aluminium corrodes less easily than iron.

Z Aluminium is not as strong as iron.

1 **W** and **X**

2 **W** and **Y**

3 **X** and **Y**

4 **Y** and **Z**

Turn over for the next question

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QUESTION FIVE

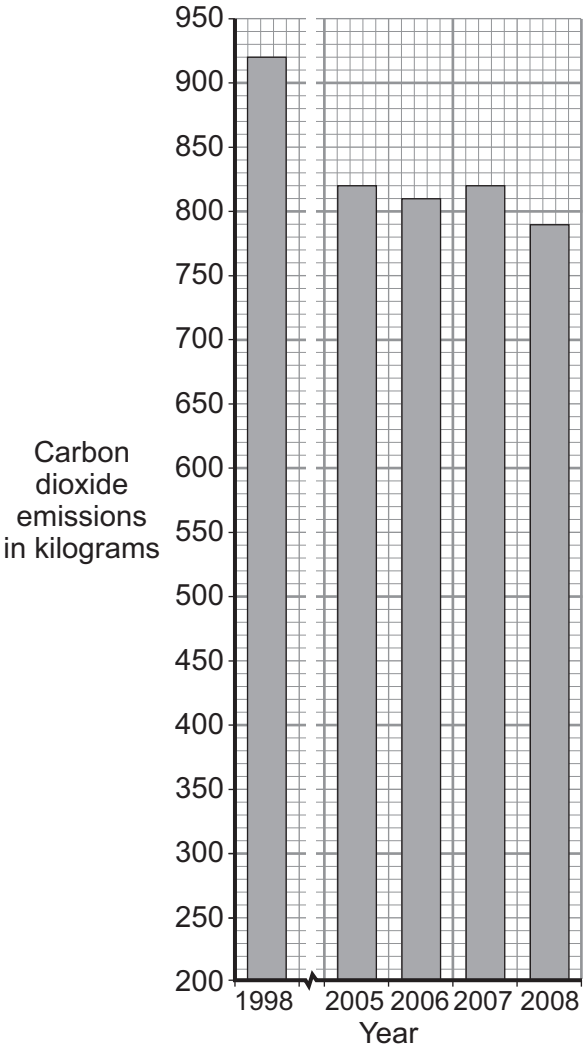
Cement is made in a rotary kiln, from a mixture of limestone and clay. The kiln is heated by burning a hydrocarbon fuel in air.

The cement industry needs to reduce carbon dioxide emissions.

Graphs 1 and **2** show carbon dioxide emissions from cement manufacture in Britain, between 1998 and 2008.

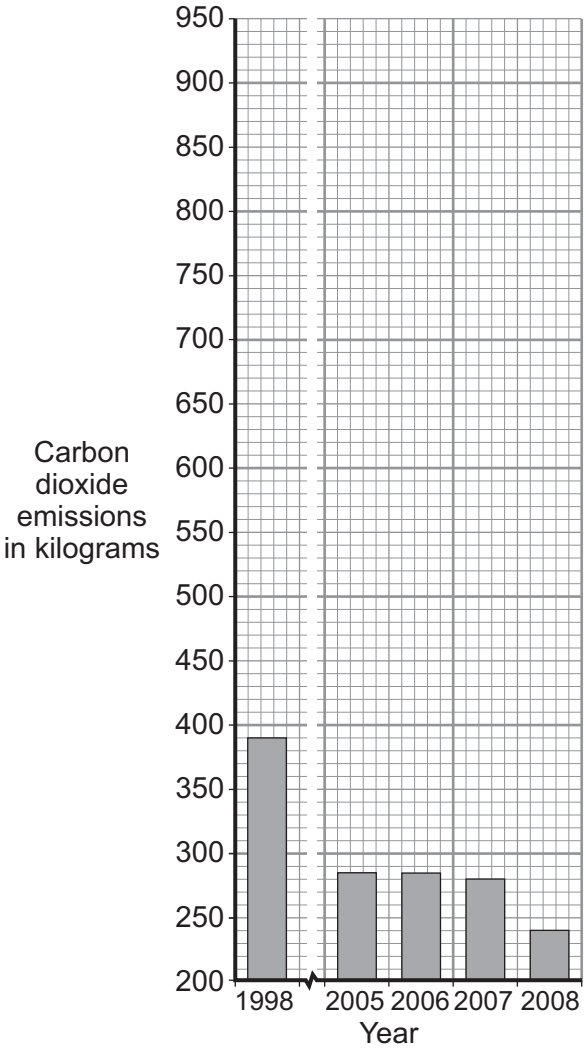
Graph 1

Total carbon dioxide emissions from factories per tonne of cement manufactured



Graph 2

Carbon dioxide emissions from combustion of hydrocarbon fuels per tonne of cement manufactured



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5A A correct conclusion from the information in the graphs is that . . .

1 the largest reduction in total emissions of carbon dioxide was from 1998 to 1999.

2 the largest reduction in emissions of carbon dioxide from combustion of hydrocarbon fuels was from 2007 to 2008.

3 from 2007 to 2008, total emissions of carbon dioxide, per tonne of cement manufactured, reduced by 40 kilograms.

4 from 2007 to 2008, emissions of carbon dioxide from combustion of hydrocarbon fuels, per tonne of cement manufactured, reduced by 40 kilograms.

5B What was the percentage reduction in emissions of carbon dioxide from combustion of hydrocarbon fuels at cement factories between 1998 and 2008?

1 16.2 %

2 38.5 %

3 61.5 %

4 84.4 %

5C What proportion of the carbon dioxide released during cement manufacture in 2006 came from combustion of hydrocarbon fuels?

1 0.23

2 0.35

3 0.61

4 0.85

5D Most of the carbon dioxide released during cement manufacture comes from . . .

1 hydrocarbons.

2 limestone.

3 quicklime.

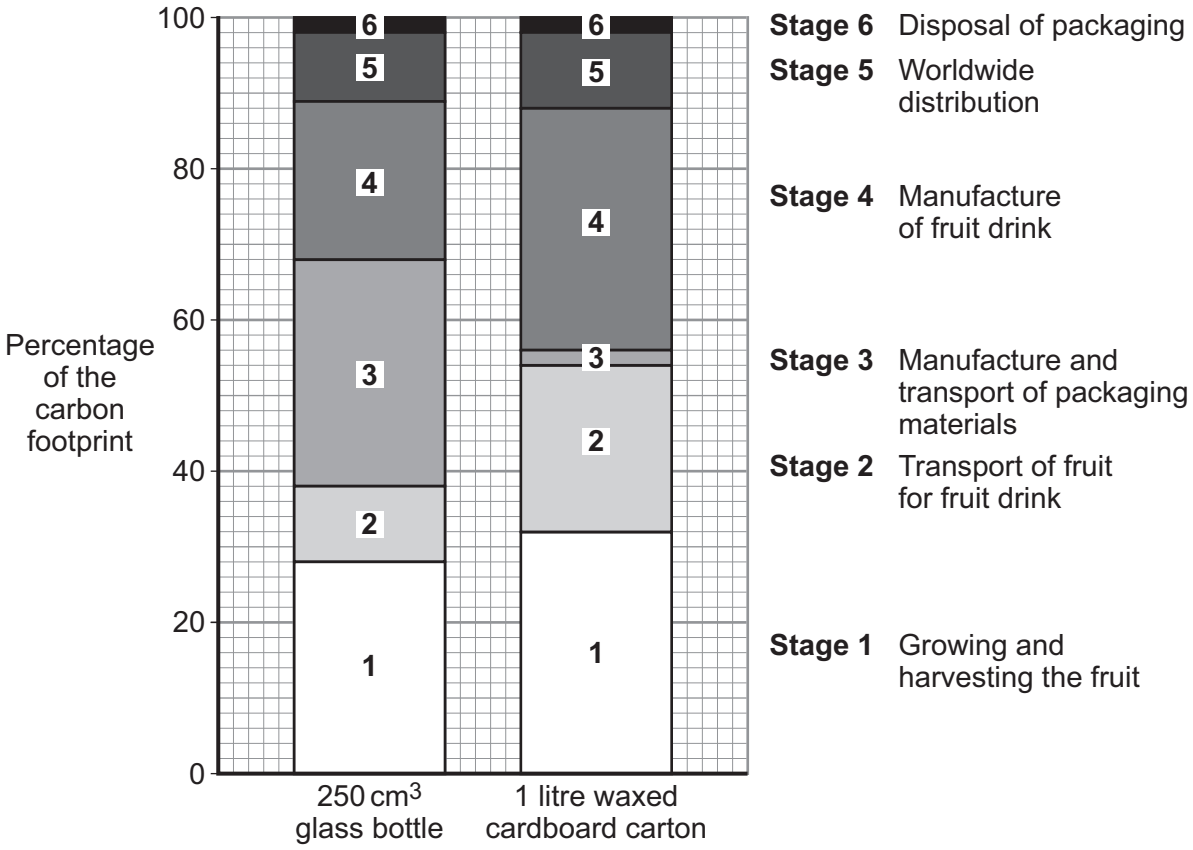
4 slaked lime.

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QUESTION SIX

The carbon footprint of a food product is the total amount of carbon dioxide that is produced in its preparation, distribution and disposal.

The bar chart shows the percentage (%) of the carbon footprint for each stage of the overall process for a natural fruit drink. The fruit drink is packaged either in a 250 cm^3 glass bottle or in a 1 litre waxed cardboard carton.



6A Most of the carbon dioxide produced at **Stage 5** will be . . .

1 by electric trolleys at the supermarket storage depot.

2 by lorries delivering bottles and cartons of the fruit drink.

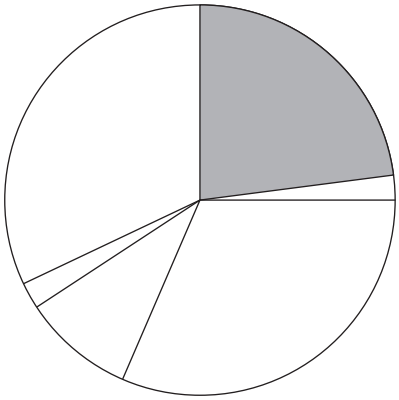
3 by refrigerators at the supermarket storage depot.

4 by the large workforce at the distribution centre.

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6B Which stage on the bar chart for a 1 litre carton corresponds to the shaded area on the pie chart?

Percentage (%) of carbon footprint for a 1 litre carton of natural fruit drink



1 **Stage 1**

2 **Stage 2**

3 **Stage 3**

4 **Stage 4**

6C One reason why, at **Stage 2**, the carbon footprint percentage is much smaller for a 250 cm^3 glass bottle than for a 1 litre carton is that . . .

1 a bottle contains a larger volume of liquid than a carton.

2 a bottle is heavier than a carton.

3 more fruit is needed to make the juice in a carton than in a bottle.

4 the fruit for the juice in the bottles is transported further than that for the juice in the cartons.

6D There is a large difference in the percentages at **Stage 3**.

One possible reason for this is that . . .

1 cartons are made of renewable materials.

2 making glass bottles needs a lot of energy.

3 cartons need more protective packaging than bottles.

4 glass bottles can be recycled but cartons cannot.

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QUESTION SEVEN

Titanium (Ti) is extracted from the ore called rutile. Rutile is mainly made up of titanium oxide (TiO_2). Titanium is not very reactive so it should be possible to displace titanium from its oxide with carbon. But carbon reacts with titanium, making it very brittle.

Therefore, titanium is extracted by reacting titanium chloride ($TiCl_4$) with sodium. Titanium chloride is produced by reacting titanium oxide with chlorine. The sodium used for the reaction is obtained by electrolysis.

The titanium chloride is added to a reactor in which sodium has been heated to about 550 °C in an inert argon atmosphere. During the reaction, the temperature increases to about 1000 °C.
After the reaction is complete, and everything has cooled, which can take several days, the mixture is crushed and washed with water to remove the sodium chloride (NaCl).

7A Which row in the table is the correct order of reactivity for carbon, sodium and titanium?

	Most reactive ⟶		**Least reactive**
1	sodium	carbon	titanium
2	carbon	titanium	sodium
3	titanium	carbon	sodium
4	sodium	titanium	carbon

7B The equation for the reaction of titanium chloride with sodium is shown below.

$$TiCl_4 + 4Na \rightarrow Ti + 4NaCl$$

When 190 g of titanium chloride were reacted with sodium, 48 g of titanium and 234 g of sodium chloride were produced.

How much sodium is required to produce 48 g of titanium?

1 23 g

2 92 g

3 190 g

4 234 g

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7C A student suggested that there are four possible reasons why titanium is expensive.

J the cost of the process used to remove the sodium chloride
K large amounts of energy are needed to produce the sodium
L it takes several days to complete the process of separating the mixture
M the reacting mixture needs to be cooled to a low temperature

Which two of these reasons are correct?

1 **J** and **M**

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

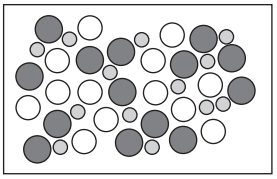
3 **J** and **K**

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

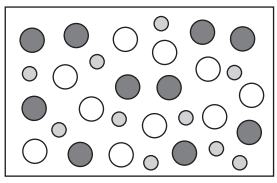
7D Titanium is often alloyed with small amounts of vanadium (4 %) and aluminium (6 %). This makes the titanium harder and stronger.

Which of the diagrams below shows the atoms in a sample of this titanium alloy?

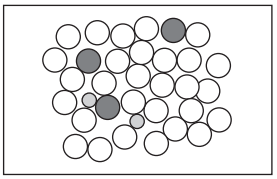
1



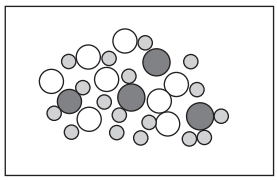
2

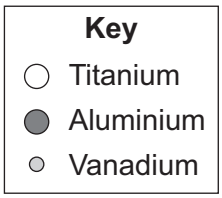


3



4





Turn over for the next question

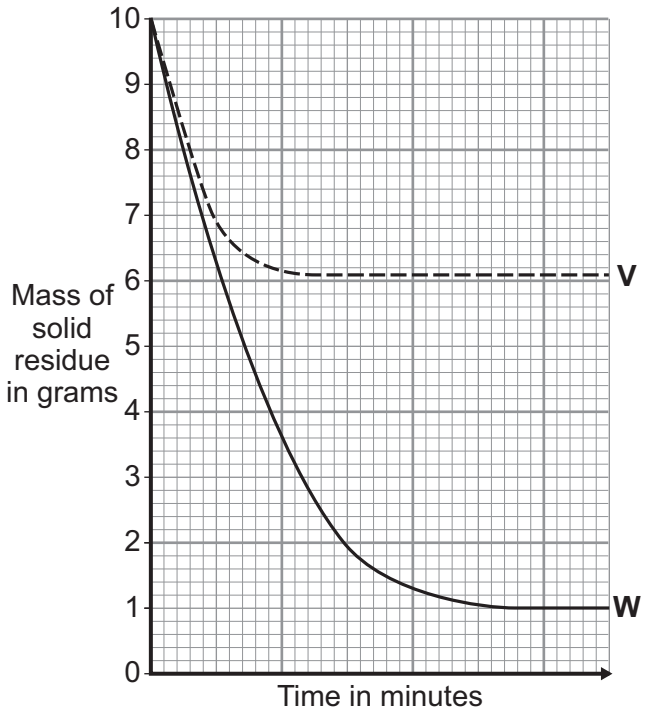
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QUESTION EIGHT

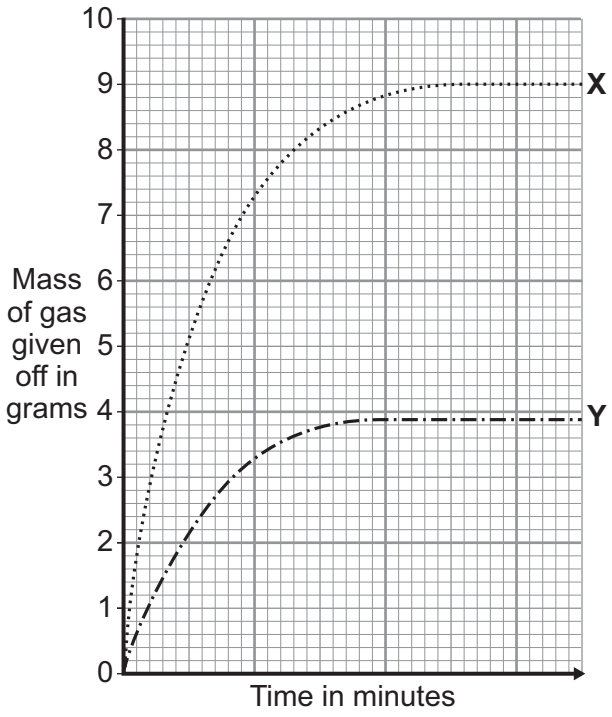
This question is about limestone and dolomite.

8A 10 g of limestone, which contained 10 % of an unreactive impurity, was heated strongly. The mass of the solid residue (**Graph 1**) and the mass of gas (**Graph 2**) given off were both recorded against time.

Graph 1



Graph 2



Which of the following lines on the graphs would be produced?

1 **V** and **X**

2 **V** and **Y**

3 **W** and **X**

4 **W** and **Y**

8B The formula for dolomite can be written as $CaMg(CO_3)_2$

What is the total number of atoms shown in this formula for dolomite?

1 4

2 7

3 10

4 12

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8C Dolomite contains calcium carbonate and magnesium carbonate.

Magnesium carbonate decomposes when heated to temperatures above 540 °C.
Calcium carbonate decomposes when heated to temperatures above 900 °C.

Which row in the table correctly describes what happens when dolomite is heated to 750 °C?

	Calcium carbonate	Magnesium carbonate
1	No change	Undergoes reduction
2	Undergoes reduction	No change
3	No change	Undergoes thermal decomposition
4	Undergoes thermal decomposition	No change

8D Which of the following correctly completes and balances the equation for the total decomposition of dolomite?

$CaMg(CO_3)_2 \rightarrow$

1 $CaO + 2MgO + CO_2$

2 $CaO + Mg + 2CO_2$

3 $CaO + MgO + 2CO_2$

4 $Ca + Mg + 3CO_2$

Turn over for the next question

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QUESTION NINE

Petrol and diesel are the fuels used for most cars.

Several companies are researching the use of hydrogen as a fuel for cars, instead of petrol or diesel.

Hydrogen can be used to power fuel cells. In a fuel cell, hydrogen is chemically combined with oxygen to generate electricity to run the car.

Hydrogen can be produced from natural gas or from water.

9A There are several reasons why this research is being carried out.

Which of the following is **not** one of the reasons?

1 There could be a shortage of petrol and diesel in the future.

2 There is political pressure to increase the number of cars on the road.

3 Petrol and diesel are obtained from a non-renewable source.

4 There is political pressure to reduce carbon emissions.

9B One reason why there are only a few hydrogen-powered cars on the road is that . . .

1 the raw materials to make hydrogen are scarce.

2 only water is produced when hydrogen burns.

3 fuel cell technology has been difficult to develop.

4 hydrogen-powered cars are made by only a few companies.

9C The development of hydrogen as a fuel for cars could be delayed even further if . . .

1 new, large deposits of crude oil are discovered.

2 a safe way of storing hydrogen is found.

3 hydrogen can be made more cheaply.

4 global warming continues to be a concern.

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9D The very rare and expensive metal called palladium is capable of storing many hundreds of times its own volume of hydrogen.

Which statement would be true if palladium was used in hydrogen-powered cars?

1 The increased demand for palladium would cause its price to fall.

2 Hydrogen that had been stored in palladium would have a lower density.

3 Hydrogen that had been stored in palladium would be hard to burn.

4 The cars would be safer than those that store hydrogen in pressurised cylinders.

END OF TEST

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There are no questions printed on this page

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GCSE

Science A (4461) / Chemistry (4421)

Specification A

CHY1AP, CH1ASF & CH1ASH

Mark Scheme

2011 Examination – November Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the students' responses.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

November 2011

Foundation Tier

Question	Key		
One	**A**	hard	**3**
	B	resistant to corrosion	**4**
	C	easily shaped	**2**
	D	brittle	**1**
Two	**A**	Chalcocite	**2**
	B	Chalcopyrite	**1**
	C	Cuprite	**3**
	D	Malachite	**4**
Three	**A**	a bond	**3**
	B	an electron	**2**
	C	a molecule	**4**
	D	a nucleus	**1**
Four	**A**	Methane	**2**
	B	Ethane	**4**
	C	Propane	**1**
	D	Butane	**3**
Five	**A**	Carbon dioxide	**2**
	B	Methane and hot air	**3**
	C	Limestone	**1**
	D	Quicklime	**4**

	A	B	C	D
Six	**4**	**2**	**2**	**4**
Seven	**3**	**2**	**2**	**1**
Eight	**3**	**1**	**2**	**3**
Nine	**3**	**2**	**1**	**2**

GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

November 2011

Higher Tier

Question	Key		
One	**A**	Carbon dioxide	**2**
	B	Methane and hot air	**3**
	C	Limestone	**1**
	D	Quicklime	**4**
Two	**A**	Hydrocarbons turn to vapour	**1**
	B	Hydrocarbons cool	**3**
	C	Hydrocarbons with low boiling points	**2**
	D	Hydrocarbons condense to form liquids	**4**

	A	**B**	**C**	**D**
Three	**3**	**1**	**2**	**3**
Four	**3**	**2**	**1**	**2**
Five	**4**	**2**	**2**	**2**
Six	**2**	**2**	**3**	**2**
Seven	**1**	**2**	**2**	**3**
Eight	**2**	**3**	**3**	**3**
Nine	**2**	**3**	**1**	**4**

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http://www.aqa.org.uk/umsconversion

OTQ3

GCSE SCIENCE

AQA

Unit : CHY1AP **CHEMISTRY UNIT 1A**

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : BG11

15-NOV-11

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	Carbon dioxide	○	○	○	○
1B	Methane and hot air	○	○	○	○
1C	Limestone	○	○	○	○
1D	Quicklime	○	○	○	○

QUESTION TWO		1	2	3	4
2A	Hydrocarbons turn to vapour	○	○	○	○
2B	Hydrocarbons cool	○	○	○	○
2C	Hydrocarbons with low boiling points	○	○	○	○
2D	Hydrocarbons condense to form liquids	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A hard	○	○	○	○
1B resistant to corrosion	○	○	○	○
1C easily shaped	○	○	○	○
1D brittle	○	○	○	○

QUESTION TWO	1	2	3	4
2A Chalcocite	○	○	○	○
2B Chalcopyrite	○	○	○	○
2C Cuprite	○	○	○	○
2D Malachite	○	○	○	○

QUESTION THREE	1	2	3	4
3A a bond	○	○	○	○
3B an electron	○	○	○	○
3C a molecule	○	○	○	○
3D a nucleus	○	○	○	○

QUESTION FOUR	1	2	3	4
4A Methane	○	○	○	○
4B Ethane	○	○	○	○
4C Propane	○	○	○	○
4D Butane	○	○	○	○

QUESTION FIVE	1	2	3	4
5A Carbon dioxide	○	○	○	○
5B Methane and hot air	○	○	○	○
5C Limestone	○	○	○	○
5D Quicklime	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
June 2011

Science A

Unit Chemistry C1a (Products from Rocks)

Chemistry

Unit Chemistry C1a (Products from Rocks)

CHY1AP

F&H

Tuesday 28 June 2011 Morning Session

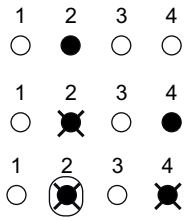
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.

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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 gases produced when a fuel burns.

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

A carbon dioxide

B carbon monoxide

C sulfur dioxide

D water vapour

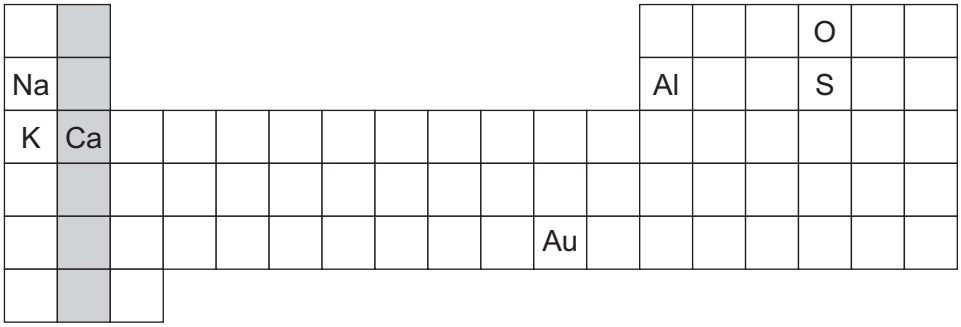
1	It is the main cause of acid rain.
2	It is only produced by incomplete combustion of the fuel.
3	It is a cause of global warming.
4	It is produced from hydrogen in the fuel.

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QUESTION TWO

The diagram shows part of the periodic table.

One vertical column has been shaded.



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

A compounds

B groups

C properties

D symbols

The elements in the periodic table are represented by . . . **1** . . . .

The vertical columns in the periodic table are called . . . **2** . . . .

Na (sodium) and K (potassium) have similar chemical . . . **3** . . . .

Some of the elements react together to form . . . **4** . . . .

Turn over for the next question

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QUESTION THREE

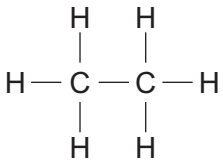
This question is about four alkanes, **A**, **B**, **C** and **D**.

	Alkane	Formula	Boiling point in °C
A	Methane	CH_4	−162
B	Ethane	C_2H_6	−89
C	Butane	C_4H_{10}	0
D	Nonane	C_9H_{20}	+150

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

The alkane with the lowest boiling point is . . . **1** . . . .

The alkane with 14 atoms in each molecule is . . . **2** . . . .

The alkane with the structural formula  is . . . **3** . . . .

The alkane which is least flammable is . . . **4** . . . .

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QUESTION FOUR

The table gives some information about four metals, **A**, **B**, **C** and **D**.

	Metal	Main ore	Price in £ per tonne	Percentage abundance of the metal in the Earth's crust
A	Aluminium	Bauxite, Al_2O_3	1800	7
B	Copper	Chalcopyrite, $CuFeS_2$	3300	0.005
C	Tin	Cassiterite, SnO_2	8000	0.0002
D	Iron	Haematite, Fe_2O_3	30	4

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

1	It is the least expensive metal.
2	It is the least abundant metal.
3	The main ore of this metal is not an oxide.
4	This metal cannot be obtained from its main ore by reduction with carbon.

Turn over for the next question

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QUESTION FIVE

A mixture of iron oxide and aluminium reacts when heated.

This is the balanced equation for the reaction:

$$Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$$

Symbols	
Fe	Iron
O	Oxygen
Al	Aluminium

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

A electrons

B bonds

C products

D elements

Iron oxide and aluminium are the reactants. Aluminium oxide and iron are the . . . **1** . . . .

Aluminium atoms and oxygen atoms combine by transferring . . . **2** . . . .

The particles (ions) in aluminium oxide are held together by . . . **3** . . . .

The equation is balanced because, in the reaction, there is no change in the total number of atoms of each of the . . . **4** . . . .

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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

Copper is in high demand. Copper is extracted from ores containing copper sulfide. Most of these ores contain only low percentages of copper sulfide.

The copper sulfide is heated in a furnace. Oxygen is blown through the molten copper sulfide. Copper and sulfur dioxide are produced.

6A A company uses copper sulfide ores to produce copper.

The company will make more profit if . . .

1 the cost of the fuel to heat the furnace increases.

2 the ores contain a higher percentage of copper sulfide.

3 their workers are paid more.

4 there is a reduced demand for copper.

6B The company wants to know the amount of sulfur dioxide released into the atmosphere from the chemical works.

It would be best to measure the amount of sulfur dioxide . . .

1 in the nearest town.

2 in the area around the chemical works.

3 in the gases coming out of the chimneys at the chemical works.

4 in the country as a whole.

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6C The company wants to know the total amount of sulfur dioxide given off by the chemical works in a 24-hour period.

The best way to calculate this would be from measurements taken . . .

1 at midday.

2 at 10.00 am and 10.00 pm.

3 at 9.00 am, midday and 4.00 pm.

4 every hour.

6D Ores containing very low percentages of copper sulfide are being used to produce copper.

One factor that would increase the use of these ores is . . .

1 the discovery of large deposits of high grade copper ore.

2 an increase in the use of plastics instead of copper for water pipes.

3 a large increase in the price of copper.

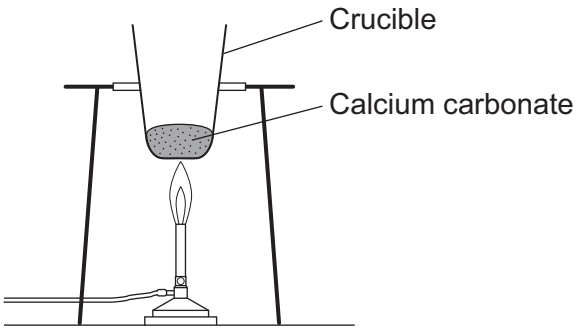
4 an increase in the amount of copper that is recycled.

Turn over for the next question

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QUESTION SEVEN

A student investigated the change in mass when two metal carbonates were heated.
He heated 4.00 g of calcium carbonate in an open crucible. He measured the mass of crucible and contents every minute for 6 minutes.



He then repeated the whole experiment in the same way but used 4.00 g of copper carbonate in the same crucible.

The student's results are shown in the table.

	Time in minutes	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Calcium carbonate	Mass of crucible and contents in g	24.00	23.02	22.50	22.35	22.31	22.24	22.24
Copper carbonate	Mass of crucible and contents in g	24.00	23.32	22.82	22.58	22.58	22.58	22.58

7A The results show that . . .

1 both carbonates were fully decomposed after 3 minutes.

2 copper carbonate showed the larger loss in mass after 6 minutes.

3 copper carbonate was the first to be fully decomposed.

4 neither carbonate was fully decomposed after 6 minutes.

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7B The change in mass in both experiments is because carbon dioxide gas is lost from the crucible.

During which period of time was most carbon dioxide lost?

1 0 – 1 minutes

2 1 – 2 minutes

3 2 – 3 minutes

4 5 – 6 minutes

7C The student could find a more precise time for the end of each reaction by . . .

1 heating larger masses of the calcium and copper carbonates.

2 measuring the mass of the crucible and contents every 30 seconds.

3 heating the carbonates in a larger crucible.

4 measuring the mass of the crucible and contents for another 3 minutes.

7D One variable that is difficult to control in the experiment is . . .

1 the mass of the crucible.

2 the masses of the calcium carbonate and copper carbonate.

3 the times for which the calcium carbonate and copper carbonate are heated.

4 the temperature of the crucible.

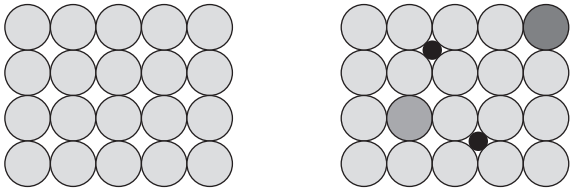
Turn over for the next question

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QUESTION EIGHT

This question is about iron and different types of steel.

8A The diagrams show the arrangement of atoms in pure iron and in stainless steel.



Pure iron Stainless steel

Pure iron is soft and easily shaped because the atoms . . .

1 are not arranged in a regular pattern.

2 are small and spherical.

3 are in layers that can slide over each other.

4 are of different sizes.

8B Stainless steel rather than pure iron is used for making cutlery.

Which row in the table gives two reasons why stainless steel is used?

Stainless steel . . .		
1	is harder.	is a better heat conductor.
2	is more resistant to corrosion.	is harder.
3	is a better heat conductor.	can be more easily shaped.
4	can be more easily shaped.	is more resistant to corrosion.

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8C Which type of iron or steel is used to make hammer heads and chisels?

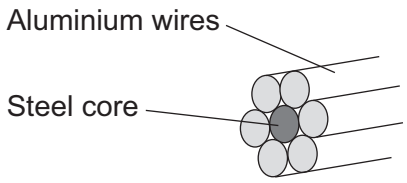
1 cast iron (iron from a blast furnace)

2 pure iron

3 low carbon steel

4 high carbon steel

8D The diagram shows the structure of an overhead power cable. The steel core gives strength to the cable.



Aluminium is used because it is a good conductor of electricity and . . .

1 it has a low density.

2 it is a good conductor of heat.

3 it can be hammered into shape.

4 it is a hard metal.

Turn over for the next question

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QUESTION NINE

Crude oil is a mixture made up mainly of alkanes.

9A The alkanes are a series of hydrocarbons . . .

1 all of which are gases at room temperature (20 °C).

2 that have the general formula $C_nH_{2n.}$

3 in which the molecules have a carbon : hydrogen ratio of 1 : 4.

4 that are saturated.

Crude oil can be separated into fractions by fractional distillation.

9B In the fractionating column, the crude oil separates into fractions because . . .

1 the crude oil changes from a liquid into a vapour.

2 the alkanes condense at different temperatures.

3 the crude oil decomposes when it is heated.

4 the alkanes have different densities.

9C The petrol fraction has a boiling range from 40 °C to 70 °C.

The fraction does not have a fixed boiling point because it . . .

1 contains only one alkane.

2 contains several alkanes.

3 collects near the top of the column.

4 decomposes at 40 °C.

9D The petrol fraction is used as a fuel. Ethanol (C_2H_5OH), made from plant material, can be used as a fuel instead of petrol.

One advantage of ethanol over petrol is that ethanol . . .

1 does not produce carbon dioxide when it burns.

2 is a renewable fuel.

3 produces only water when it burns.

4 is a compound, not a mixture.

END OF TEST

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There are no questions printed on this page

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

A mixture of iron oxide and aluminium reacts when heated.

This is the balanced equation for the reaction:

$$Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$$

Symbols	
Fe	Iron
O	Oxygen
Al	Aluminium

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

A electrons

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Iron oxide and aluminium are the reactants. Aluminium oxide and iron are the . . . **1** . . . .

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The particles (ions) in aluminium oxide are held together by . . . **3** . . . .

The equation is balanced because, in the reaction, there is no change in the total number of atoms of each of the . . . **4** . . . .

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QUESTION TWO

This question is about four carbon compounds that burn in air.

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

A CO

B CS_2

C C_2H_4

D C_3H_8

1	It burns to form carbon dioxide only.
2	It is a hydrocarbon but it is not an alkane.
3	It is in the series with the general formula C_nH_{2n+2}
4	It burns to form carbon dioxide and sulfur dioxide.

Turn over for the next question

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Section Two

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

Each of these questions has four parts.

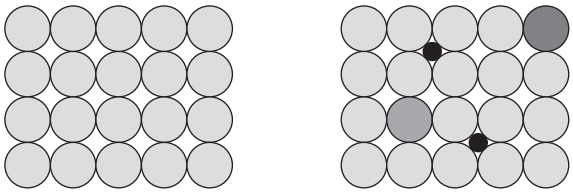
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

This question is about iron and different types of steel.

3A The diagrams show the arrangement of atoms in pure iron and in stainless steel.



Pure iron Stainless steel

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2 are small and spherical.

3 are in layers that can slide over each other.

4 are of different sizes.

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Which row in the table gives two reasons why stainless steel is used?

Stainless steel . . .		
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2	is more resistant to corrosion.	is harder.
3	is a better heat conductor.	can be more easily shaped.
4	can be more easily shaped.	is more resistant to corrosion.

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3C Which type of iron or steel is used to make hammer heads and chisels?

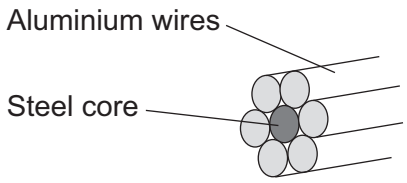
1 cast iron (iron from a blast furnace)

2 pure iron

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4 high carbon steel

3D The diagram shows the structure of an overhead power cable. The steel core gives strength to the cable.



Aluminium is used because it is a good conductor of electricity and . . .

1 it has a low density.

2 it is a good conductor of heat.

3 it can be hammered into shape.

4 it is a hard metal.

Turn over for the next question

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QUESTION FOUR

Crude oil is a mixture made up mainly of alkanes.

4A The alkanes are a series of hydrocarbons . . .

1 all of which are gases at room temperature (20 °C).

2 that have the general formula $C_nH_{2n.}$

3 in which the molecules have a carbon : hydrogen ratio of 1 : 4.

4 that are saturated.

Crude oil can be separated into fractions by fractional distillation.

4B In the fractionating column, the crude oil separates into fractions because . . .

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The fraction does not have a fixed boiling point because it . . .

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4D The petrol fraction is used as a fuel. Ethanol (C_2H_5OH), made from plant material, can be used as a fuel instead of petrol.

One advantage of ethanol over petrol is that ethanol . . .

1 does not produce carbon dioxide when it burns.

2 is a renewable fuel.

3 produces only water when it burns.

4 is a compound, not a mixture.

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Turn over for the next question

QUESTION FIVE

Iron and copper can be extracted from their oxides by reduction with carbon.
Aluminium cannot be extracted from its oxide in this way.

Copper can be found in the Earth's crust as the metal itself.
Iron and aluminium are found only as compounds in the Earth's crust.

5A Which row in the table shows the order of reactivity of the four elements in the passage above?

	Most reactive ⟶			**Least reactive**
1	copper	iron	aluminium	carbon
2	aluminium	carbon	iron	copper
3	carbon	copper	iron	aluminium
4	iron	aluminium	copper	carbon

5B Iron can be extracted from iron oxide, Fe_2O_3, by mixing the oxide with carbon and heating strongly in air.

Which row in the table below shows the name of the process and the products of the reaction?

	Name of the process	**Products of the reaction**
1	electrolysis	Fe, O_2 and CO_2
2	reduction	Fe and CO_2
3	electrolysis	Fe and CO_2
4	reduction	Fe, O_2 and CO_2

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5C Copper is extracted from high grade ores by first heating them strongly in a furnace to obtain impure copper. This is called smelting. Pure copper is then obtained by electrolysis.

Copper is extracted from low grade ores by leaching. A solution of sulfuric acid is run through the ores to produce a solution of copper sulfate. Electrolysis of this solution gives pure copper.

An advantage of leaching over smelting is that . . .

1 leaching uses less energy.

2 leaching causes no environmental damage.

3 leaching leaves no waste.

4 leaching produces purer copper.

5D Extraction of aluminium from its ores requires a lot of energy. Aluminium obtained by recycling scrap aluminium saves about 95% of this energy.

Another advantage of recycling scrap aluminium is that . . .

1 large, new aluminium ore mines will be developed.

2 alternative metals will replace aluminium in making drinks cans.

3 deposits of aluminium ore will last longer.

4 recycled aluminium contains other metals.

Turn over for the next question

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QUESTION SIX

In 1774, a Frenchman called Antoine Lavoisier put forward this theory:

> "*Matter can neither be created nor destroyed, and in every chemical reaction there is just as much matter present before, as after the reaction has taken place*."

6A This theory is now an accepted law of chemistry.

This law means that in any chemical reaction . . .

1 the mass of the products is equal to the mass of the reactants.

2 new atoms are produced from the atoms which make up the reactants.

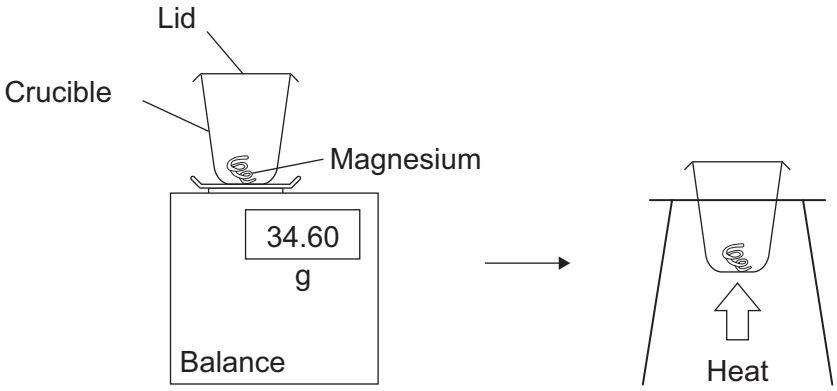
3 the number of molecules of reactants is equal to the number of molecules of products.

4 atoms of elements react by giving, taking or sharing electrons.

A student investigated the reaction when some magnesium burned completely in oxygen.

magnesium + oxygen → magnesium oxide

The student weighed a crucible, its lid and a piece of magnesium.



The student then:

- heated the crucible for one minute, raising the lid occasionally
- allowed the crucible, lid and contents to cool, and then reweighed them
- repeated the heating, cooling and reweighing several times.

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The results are shown in the table.

Total time of heating in minutes	0	1	2	3	4	5	6
Mass of crucible, lid and contents in grams	34.60	34.92	35.00	35.07	35.10	35.10	35.10

6B Which row in the table below correctly explains the procedures in the experiment?

	Reason for:	
	raising the crucible lid occasionally	**repeating the heating, cooling and reweighing**
1	so the crucible would not get too hot	to check the accuracy of the balance
2	to allow air to enter the crucible	to make sure that all the magnesium had reacted
3	to allow air to enter the crucible	to check the accuracy of the balance
4	so the crucible would not get too hot	to make sure that all the magnesium had reacted

6C Why do the results in this experiment appear to contradict Lavoisier's theory?

1 The mass of reacting oxygen was not included in the weighings.

2 Magnesium oxide is a compound but magnesium and oxygen are elements.

3 There was not enough oxygen for all of the magnesium to react.

4 The mass of magnesium used was too small.

6D From calculations done before the experiment, the student expected the final mass of the crucible, lid and contents to be 35.32 grams rather than 35.10 grams.

The best explanation for this difference is that . . .

1 the student did not heat the crucible to a high enough temperature.

2 some magnesium oxide escaped from the crucible.

3 magnesium oxide begins to decompose at the temperature of the Bunsen burner.

4 the student did not allow the crucible to completely cool each time.

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QUESTION SEVEN

Calcium carbonate decomposes on heating to give calcium oxide and carbon dioxide.

$$CaCO_3 \rightarrow CaO + CO_2$$

100 g of calcium carbonate, on complete decomposition, produces 44 g of carbon dioxide.

If the carbon dioxide is not allowed to escape, it will recombine with the calcium oxide. This can happen at any temperature.

7A Calculate the mass of calcium oxide that would be produced by completely decomposing 400 tonnes of calcium carbonate.

(1 tonne = 1 000 000 g)

1 17.6 tonnes

2 22.4 tonnes

3 176 tonnes

4 224 tonnes

7B If calcium oxide is left exposed to the air, it will increase in mass.

Which of the following could **not** be the reason for this?

1 The calcium oxide is recombining with carbon dioxide from the air.

2 The calcium oxide is reacting with water from the air.

3 The calcium oxide is still thermally decomposing.

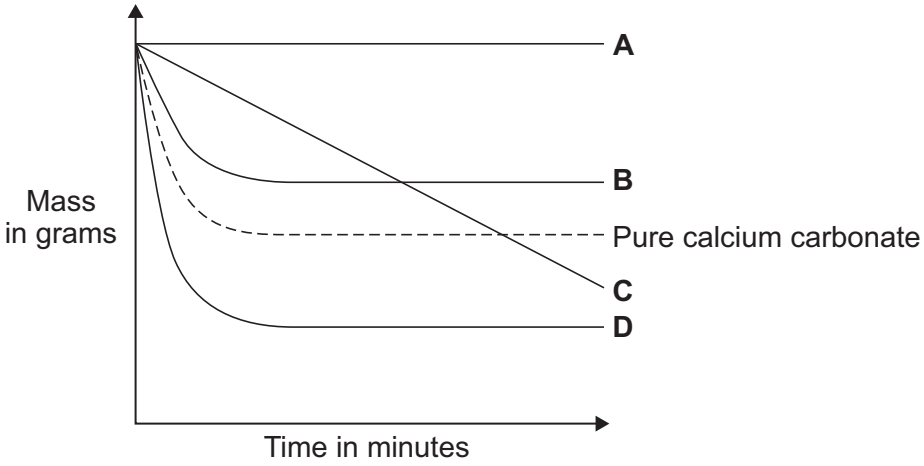
4 The calcium oxide is changing back to calcium carbonate.

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7C Limestone usually contains impurities.

The diagram below shows the change in mass when pure calcium carbonate is heated.

Which of the lines, **A**, **B**, **C** or **D,** shows a sample of limestone containing impurities that do not thermally decompose?



1 **A**

2 **B**

3 **C**

4 **D**

7D A company makes calcium oxide from calcium carbonate.

The best way for this company to benefit economically, **and** also to limit environmental damage, is to . . .

1 store the carbon dioxide in spaces underground which are left when coal has been extracted.

2 sell the carbon dioxide to oil companies so that they can use it to force oil out of the ground.

3 sell solid carbon dioxide to ice-cream companies for keeping ice-cream cold.

4 sell the carbon dioxide to companies that make fizzy drinks.

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QUESTION EIGHT

This question is about alkanes.

Alkane	Melting point in °C	Boiling point in °C
Methane, CH_4	−183	−164
Ethane, C_2H_6	−183	−89
Propane, C_3H_8	−190	−42
Butane, C_4H_{10}	−138	−0.5
Pentane, C_5H_{12}	−130	+36

8A Which of the following is correct?

1 Butane is liquid at room temperature (20 °C).

2 These alkanes will be collected separately during the fractional distillation of crude oil.

3 The boiling points of the alkanes decrease as the size of their molecules increases.

4 Pentane is liquid over the greatest range of temperature.

8B In the alkane series, which one of the following changes from one alkane to the next?

1 the general formula

2 the number of bonds on each carbon atom

3 the ratio of carbon atoms to hydrogen atoms in each molecule

4 the number of double carbon carbon bonds in each molecule

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8C The general equation below represents the burning of an alkane in excess of oxygen.

$$C_wH_x + (w + \tfrac{x}{y})O_2 \rightarrow wCO_2 + (\tfrac{x}{2})H_2O$$

The value of y is . . .

1 1

2 2

3 4

4 8

8D The complete combustion of a molecule of propane . . .

1 produces less carbon dioxide than the complete combustion of a molecule of butane.

2 requires more oxygen than the complete combustion of a molecule of pentane.

3 produces the same ratio of carbon dioxide molecules to water molecules as pentane.

4 requires less oxygen than the complete combustion of a molecule of methane.

Turn over for the next question

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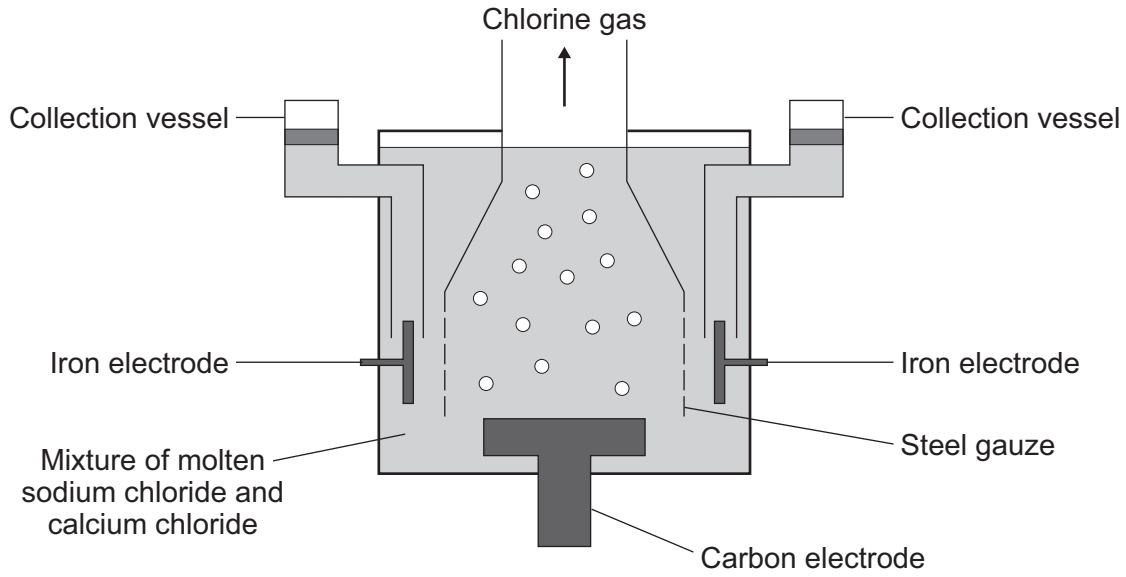
QUESTION NINE

Sodium cannot be extracted from its oxide by reduction with carbon.

Sodium metal is extracted by electrolysis of molten sodium chloride. The melting point of sodium chloride is very high (800°C), so calcium chloride is added to reduce the melting point of the mixture to about 550°C.

During electrolysis, both sodium and calcium are obtained at the iron electrodes, and chlorine at the carbon electrode.

The diagram shows the electrolysis cell used for the extraction of sodium.



The table shows some properties of sodium and calcium.

	Melting point in °C	Density in g per cm^3	Reactivity
Sodium	97	0.97	Very reactive
Calcium	839	1.55	Reactive

9A In the extraction of sodium, a mixture of sodium chloride and calcium chloride is used to . . .

1 reduce the amount of energy required to melt the mixture.

2 obtain a pure sample of sodium.

3 absorb the chlorine gas.

4 increase the temperature of the mixture.

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9B The purpose of the steel gauze is to prevent the reaction of . . .

1 sodium with calcium.

2 sodium with chlorine.

3 iron electrodes with sodium chloride.

4 sodium chloride with calcium chloride.

9C In the collection vessel there is . . .

1 solid sodium below a layer of liquid calcium.

2 solid calcium below a layer of liquid sodium.

3 a mixture of liquid sodium and liquid calcium.

4 a mixture of solid calcium and solid sodium.

9D The information in the diagram suggests that the element carbon . . .

1 has a melting point lower than 550 °C.

2 reacts rapidly with chlorine gas.

3 is an electrical conductor.

4 is more reactive than iron.

END OF TEST

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GCSE

Science A (4461) / Chemistry (4421)

Specification A

CHY1AP, CH1ASF & CH1ASH

Mark Scheme

2011 Examination – June Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

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GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

June 2011

Foundation Tier

Question	Key		
One	**A**	Carbon dioxide	**3**
	B	Carbon monoxide	**2**
	C	Sulfur dioxide	**1**
	D	Water vapour	**4**
Two	**A**	compounds	**4**
	B	groups	**2**
	C	properties	**3**
	D	symbols	**1**
Three	**A**	Methane	**1**
	B	Ethane	**3**
	C	Butane	**2**
	D	Nonane	**4**
Four	**A**	Aluminium	**4**
	B	Copper	**3**
	C	Tin	**2**
	D	Iron	**1**
Five	**A**	electrons	**2**
	B	bonds	**3**
	C	products	**1**
	D	elements	**4**

	A	**B**	**C**	**D**
Six	**2**	**3**	**4**	**3**
Seven	**3**	**1**	**2**	**4**
Eight	**3**	**2**	**4**	**1**
Nine	**4**	**2**	**2**	**2**

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GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

June 2011

Higher Tier

Question	Key		
One	**A**	electrons	**2**
	B	bonds	**3**
	C	products	**1**
	D	elements	**4**
Two	**A**	CO	**1**
	B	CS_2	**4**
	C	C_2H_4	**2**
	D	C_3H_8	**3**

	A	B	C	D
Three	**3**	**2**	**4**	**1**
Four	**4**	**2**	**2**	**2**
Five	**2**	**2**	**1**	**3**
Six	**1**	**2**	**1**	**2**
Seven	**4**	**3**	**2**	**2**
Eight	**4**	**3**	**3**	**1**
Nine	**1**	**2**	**2**	**3**

The AQA UMS Conversion Calculator can be found at the following web address:

http://www.aqa.org.uk/umsconversion

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GCSE SCIENCE

AQA

Unit : CHY1AP **CHEMISTRY UNIT 1A**

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 6M11

28-JUN-11

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	electrons	○	○	○	○
1B	bonds	○	○	○	○
1C	products	○	○	○	○
1D	elements	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	Compound A	○	○	○	○
2B	Compound B	○	○	○	○
2C	Compound C	○	○	○	○
2D	Compound D	○	○	○	○

QUESTION THREE

	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR

	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE

	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A carbon dioxide	○	○	○	○
1B carbon monoxide	○	○	○	○
1C sulfur dioxide	○	○	○	○
1D water vapour	○	○	○	○

QUESTION TWO	1	2	3	4
2A compounds	○	○	○	○
2B groups	○	○	○	○
2C properties	○	○	○	○
2D symbols	○	○	○	○

QUESTION THREE	1	2	3	4
3A Methane	○	○	○	○
3B Ethane	○	○	○	○
3C Butane	○	○	○	○
3D Nonane	○	○	○	○

QUESTION FOUR	1	2	3	4
4A Aluminium	○	○	○	○
4B Copper	○	○	○	○
4C Tin	○	○	○	○
4D Iron	○	○	○	○

QUESTION FIVE	1	2	3	4
5A electrons	○	○	○	○
5B bonds	○	○	○	○
5C products	○	○	○	○
5D elements	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
March 2011

Science A

Unit Chemistry C1a (Products from Rocks)

Chemistry

Unit Chemistry C1a (Products from Rocks)

CHY1AP

F&H

Wednesday 2 March 2011 Morning Session

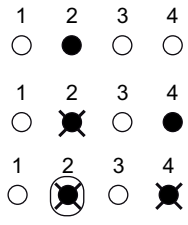
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.

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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 uses of metals.

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

A Aluminium

B Calcium

C Copper

D Iron

1	When alloyed with carbon, this metal can form a hard steel.
2	Water pipes in the home are usually made from this metal.
3	Drinks cans are made from this metal because it does not easily corrode.
4	A carbonate of this metal is used to make quicklime.

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QUESTION TWO

Statements **A**, **B**, **C** and **D**, were made during a local planning enquiry for a new limestone quarry. The quarry will be in an area of outstanding natural beauty.

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

A Quarrying leads to loss of habitat plus increased noise and dust pollution.

B Quarrying provides much needed jobs.

C Quarrying satisfies society's need for limestone and its products.

D Lakes, climbing walls and picnic areas can be created when the quarry closes.

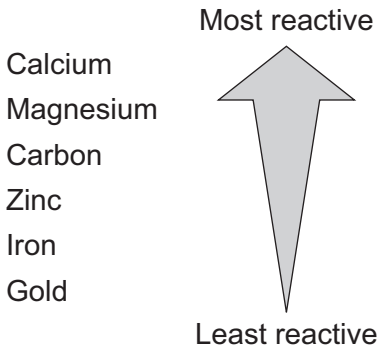
1	provides recreation for future generations
2	maintains the supply of limestone
3	be of immediate benefit to the local people
4	be harmful to wildlife in the area

Turn over for the next question

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QUESTION THREE

This is the order of reactivity for some elements.



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

A Carbon

B Gold

C Magnesium

D Zinc

1	It is a non-metal element.
2	It does not react with oxygen or water even at high temperatures.
3	It is more reactive than iron but **can** be extracted from its oxide by mixing with carbon and heating the mixture.
4	It is less reactive than calcium but **cannot** be extracted from its oxide by mixing with carbon and heating the mixture.

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QUESTION FOUR

This question is about four alkanes, **A**, **B**, **C** and **D**.

The general formula for the alkanes is $C_nH_{(2n+2)}$

	Name of alkane	Number of carbon atoms in each molecule	Boiling point in °C
A	Ethane	2	−89
B	Pentane	5	+36
C	Hexane	6	+69
D	Dodecane	12	+216

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

1	It has the lowest boiling point.
2	It has the largest molecules.
3	It has 12 hydrogen atoms in each molecule.
4	It has a total of 20 atoms in each molecule.

Turn over for the next question

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QUESTION FIVE

This question is about substances that burn in air and the gases they produce.

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

A Carbon monoxide (CO)

B Hydrogen (H_2)

C Methane (CH_4)

D Hydrogen sulfide (H_2S)

	Gases produced when the substance burns in air
1	carbon dioxide (CO_2) and water vapour (H_2O)
2	water vapour (H_2O) only
3	water vapour (H_2O) and sulfur dioxide (SO_2)
4	carbon dioxide (CO_2) only

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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

A man is going to make a concrete base for his garage.

He does an investigation to find out the ratio of sand to cement that will produce the strongest concrete:

- He makes several mixtures, changing the ratio of sand to cement.
- He measures the sand and cement quantities using a trowel.
- He makes a block of concrete with the same amount of each of the different mixtures.
- He makes the blocks exactly the same size.
- He drops a metal ball, from a measured height, onto each of the concrete blocks.
- He observes the concrete to see if it breaks.

The man starts by dropping the metal ball from a height of 10 cm onto one of the blocks. He gradually increases the height until the block breaks. He records this height.

He repeats this process with each of the concrete blocks.

The results are shown in the table below.

Trowels of sand	Trowels of cement	Height in cm
8	1	18
7	1	24
6	1	30
5	1	36
4	1	37
3	1	41
2	1	45

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6A The independent variable in this test is the . . .

1 size of the concrete blocks.

2 ratio of sand to cement.

3 type of metal ball dropped.

4 height from which the metal ball is dropped.

6B The man is not confident that the height readings of 36 cm and 37 cm are correct.

What should he do?

1 repeat all the measurements using a heavier metal ball

2 repeat the measurement for the 5:1 ratio of sand to cement

3 repeat the measurement for the 4:1 ratio of sand to cement

4 repeat the measurements for the 5:1 and 4:1 ratios of sand to cement

6C The results in the table show a pattern.

The pattern is that . . .

1 as the ratio of sand to cement decreases, the strength of the concrete increases.

2 as the quantity of sand increases, the strength of the concrete increases.

3 as the quantity of sand decreases, the concrete breaks at a lower height.

4 the strength of the concrete is directly proportional to the quantity of sand added.

6D How could the man obtain results that are more reliable?

1 use different types of cement

2 weigh out the sand with a balance

3 repeat the test for all mixtures and calculate the mean

4 add stones to some of the concrete mixtures

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QUESTION SEVEN

During December 1952, many people died in London due to smog. Smog is a mixture of smoke and sulfur dioxide.

7A Sulfur dioxide is responsible for . . .

1 global dimming.

2 global warming.

3 the greenhouse effect.

4 acid rain.

The table shows the amount of sulfur dioxide in the air in three places in London in December 1952.

	Amount of sulfur dioxide in parts per million							
Location within London	**Mean for the whole month of December 1952**	**Reading on each day in first week of December 1952**						
		1st	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**
Lambeth	0.22	0.16	0.24	0.34	0.75	0.86	1.34	0.47
Southwark	0.11	0.19	0.26	0.38	0.41	1.14	0.95	0.80
Westminster	0.16	0.15	–	0.24	0.48	0.63	0.99	0.89

7B Which of the following statements describes the pattern of the readings in the table?

1 The highest reading for sulfur dioxide is on the same day in each location.

2 The readings all rise and then fall in each location.

3 The sulfur dioxide readings are the same on the 6th December in each location.

4 The readings all rise and then stay the same in each location.

7C The most likely value for the missing reading on the 2nd December for Westminster is . . .

1 0.13

2 0.19

3 0.36

4 0.45

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7D The mean value for the whole month of December for Southwark is lower than any of the readings for the first 7 days of December for Southwark.

This is because for Southwark, . . .

1 the mean of the readings for the first 7 days in December is 0.11

2 the readings for the other days in December were all zero.

3 after 7th December, the smog became thicker.

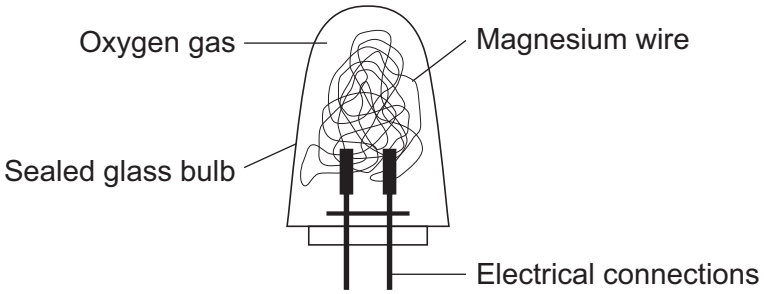
4 most of the readings for the other days in December were lower than 0.11

Turn over for the next question

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QUESTION EIGHT

The diagram shows a flash bulb that was used in photography.



When a photograph is taken, an electric current flows through the magnesium. The magnesium burns very brightly and very quickly. A white powder called magnesium oxide (MgO) is formed.

A student wanted to find out if the mass of the flash bulb changed when it was used.

- The mass of a new flash bulb was measured.
- It was made to flash and then allowed to cool.
- The glass bulb was unbroken.
- The mass of the used flash bulb was then measured.

8A Which of the following statements is correct?

The mass of the flash bulb . . .

1 did not change.

2 changed because a chemical reaction had taken place.

3 increased because a new substance had been made.

4 decreased because the magnesium and oxygen had been used up.

8B Which statement correctly describes what happens inside the flash bulb?

1 Magnesium and oxygen atoms make magnesium oxide when they mix together.

2 Magnesium and oxygen atoms combine and are held together by chemical bonds.

3 Many new magnesium and oxygen atoms are formed when there is a flash inside the flash bulb.

4 Magnesium and oxygen atoms combine to make atoms of magnesium oxide.

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8C Which row in the table gives a correct description of each substance involved in the reaction in the flash bulb?

	Substance		
	Magnesium	**Oxygen**	**Magnesium oxide**
1	element	element	compound
2	element	compound	element
3	compound	compound	element
4	element	compound	compound

8D The magnesium oxide made in this reaction can be used to produce magnesium nitrate. The formula for magnesium nitrate is $Mg(NO_3)_2$

Which row in the table below shows the numbers of each type of atom in the formula $Mg(NO_3)_2$?

	Magnesium	**Nitrogen**	**Oxygen**
1	1	1	3
2	2	1	6
3	1	2	3
4	1	2	6

Turn over for the next question

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QUESTION NINE

This question is about the extraction and recycling of copper.

Copper is used in its pure form or mixed with other metals.
Large amounts of scrap copper metal from a variety of sources can easily be recycled by re-melting.

9A Pure copper can be extracted directly by . . .

1 thermal decomposition of copper carbonate.

2 thermal decomposition of copper oxide.

3 carbon reduction of copper oxide in a blast furnace.

4 electrolysis of copper compounds dissolved in water.

9B Small amounts of other metals are sometimes added to copper to produce . . .

1 compounds that conduct electricity better.

2 compounds that are softer.

3 alloys that are harder.

4 new elements that are harder.

9C The price of copper would increase if there was . . .

1 a decrease in the demand for copper.

2 an increase in energy costs.

3 an increase in the amount of copper being recycled.

4 a discovery of a low grade copper ore in a remote area of the world.

9D One **disadvantage** of recycling copper is that it . . .

1 prevents heaps of scrap metal from building up.

2 still requires the use of energy resources.

3 will increase the price of copper.

4 will contaminate the world's supplies of copper.

END OF TEST

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There are no questions printed on this page

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 substances that burn in air and the gases they produce.

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

A Carbon monoxide (CO)

B Hydrogen (H_2)

C Methane (CH_4)

D Hydrogen sulfide (H_2S)

	Gases produced when the substance burns in air
1	carbon dioxide (CO_2) and water vapour (H_2O)
2	water vapour (H_2O) only
3	water vapour (H_2O) and sulfur dioxide (SO_2)
4	carbon dioxide (CO_2) only

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QUESTION TWO

This question is about the positions of four metals in the reactivity series.

- Only metal **C** can be extracted by heating the metal oxide in hydrogen.
- Only metals **B** and **C** can be extracted by mixing their oxides with carbon and heating strongly.
- When the oxide of metal **A** is mixed with metal **D** and heated, metal **A** is produced.

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

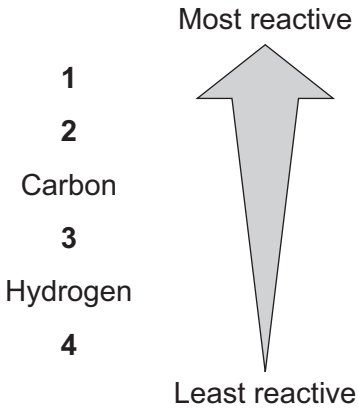
A Metal **A**

B Metal **B**

C Metal **C**

D Metal **D**

Reactivity series



Turn over for the next question

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Section Two

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

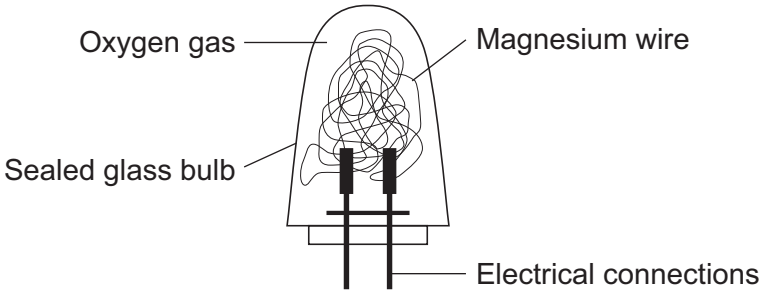
Each of these questions has four parts.

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

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QUESTION THREE

The diagram shows a flash bulb that was used in photography.



When a photograph is taken, an electric current flows through the magnesium. The magnesium burns very brightly and very quickly. A white powder called magnesium oxide (MgO) is formed.

A student wanted to find out if the mass of the flash bulb changed when it was used.

- The mass of a new flash bulb was measured.
- It was made to flash and then allowed to cool.
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- The mass of the used flash bulb was then measured.

3A Which of the following statements is correct?

The mass of the flash bulb . . .

1 did not change.

2 changed because a chemical reaction had taken place.

3 increased because a new substance had been made.

4 decreased because the magnesium and oxygen had been used up.

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3B Which statement correctly describes what happens inside the flash bulb?

1 Magnesium and oxygen atoms make magnesium oxide when they mix together.

2 Magnesium and oxygen atoms combine and are held together by chemical bonds.

3 Many new magnesium and oxygen atoms are formed when there is a flash inside the flash bulb.

4 Magnesium and oxygen atoms combine to make atoms of magnesium oxide.

3C Which row in the table gives a correct description of each substance involved in the reaction in the flash bulb?

	Substance		
	Magnesium	**Oxygen**	**Magnesium oxide**
1	element	element	compound
2	element	compound	element
3	compound	compound	element
4	element	compound	compound

3D The magnesium oxide made in this reaction can be used to produce magnesium nitrate. The formula for magnesium nitrate is $Mg(NO_3)_2$

Which row in the table below shows the numbers of each type of atom in the formula $Mg(NO_3)_2$?

	Magnesium	**Nitrogen**	**Oxygen**
1	1	1	3
2	2	1	6
3	1	2	3
4	1	2	6

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QUESTION FOUR

This question is about the extraction and recycling of copper.

Copper is used in its pure form or mixed with other metals.
Large amounts of scrap copper metal from a variety of sources can easily be recycled by re-melting.

4A Pure copper can be extracted directly by . . .

1 thermal decomposition of copper carbonate.

2 thermal decomposition of copper oxide.

3 carbon reduction of copper oxide in a blast furnace.

4 electrolysis of copper compounds dissolved in water.

4B Small amounts of other metals are sometimes added to copper to produce . . .

1 compounds that conduct electricity better.

2 compounds that are softer.

3 alloys that are harder.

4 new elements that are harder.

4C The price of copper would increase if there was . . .

1 a decrease in the demand for copper.

2 an increase in energy costs.

3 an increase in the amount of copper being recycled.

4 a discovery of a low grade copper ore in a remote area of the world.

4D One **disadvantage** of recycling copper is that it . . .

1 prevents heaps of scrap metal from building up.

2 still requires the use of energy resources.

3 will increase the price of copper.

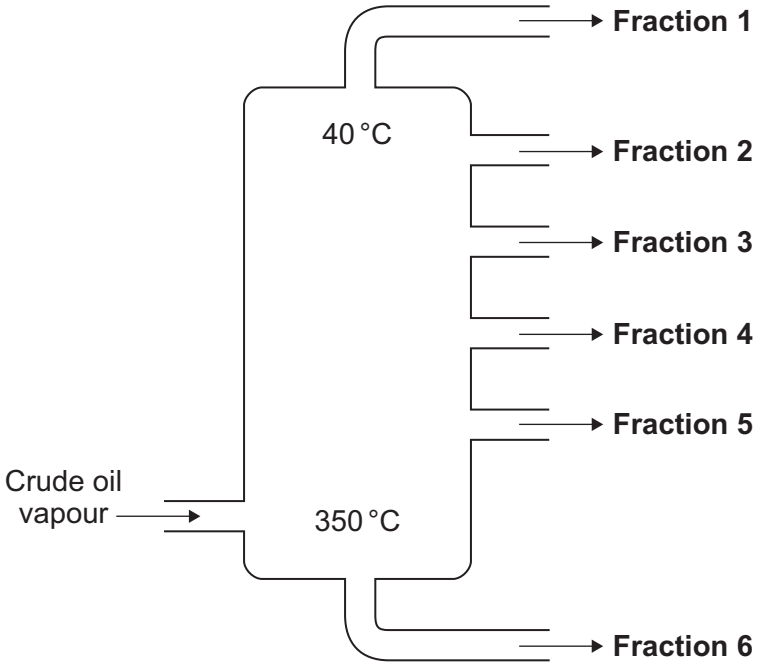
4 will contaminate the world's supplies of copper.

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Turn over for the next question

QUESTION FIVE

Crude oil can be separated into fractions by fractional distillation.



5A The fractions can be separated in this way because the hydrocarbons in the crude oil . . .

1 have different chemical properties.

2 are compounds containing only two elements.

3 are gases, liquids and solids.

4 have different boiling points.

5B Each fraction will contain . . .

1 a single alkane.

2 alkanes with the same chemical formula.

3 a mixture of alkanes.

4 alkanes with the same number of carbon atoms in each molecule.

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5C When compared with **Fraction 5**, **Fraction 3** . . .

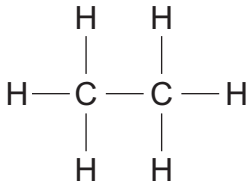
1 will be more difficult to ignite.

2 will be more volatile.

3 will be more viscous.

4 will have boiling points in a higher range.

5D The diagram shows a molecule of an alkane.



In which fraction will most of this alkane be found?

1 **Fraction 1**

2 **Fraction 2**

3 **Fraction 4**

4 **Fraction 6**

Turn over for the next question

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QUESTION SIX

Alcohols have the general formula $C_nH_{2n+1}OH$
The OH group is known as the functional group for alcohols.
Alcohols with a value of 'n' less than 4 burn completely in air without producing any carbon particles.
Alcohols with a value of 'n' greater than 4 do not burn completely in air and produce carbon particles.

Some properties of alcohols are listed in the table.

'n' value of the alcohol	Melting point in ºC	Boiling point in ºC	Solubility in water
2	−117	79	Very soluble
4	−89	117	Soluble
6	−47	158	Slightly soluble
8	−17	195	Insoluble

6A Which of the following formulae represents the alcohol with a value of n = 4?

1 C_4H_5OH

2 C_4H_8OH

3 C_4H_9OH

4 $C_4H_{10}OH$

6B An alcohol has a value of n = 10.

Which row in the table shows the likely properties of this alcohol?

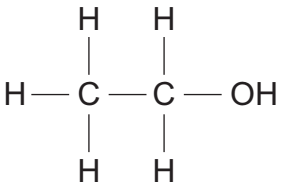
	Melting point in ºC	Boiling point in ºC	Solubility in water
1	10	230	Insoluble
2	−4	235	Slightly soluble
3	0	200	Insoluble
4	5	200	Slightly soluble

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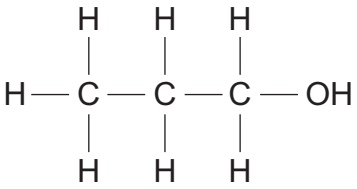
6C There are two possible structures for an alcohol with a value of n = 3.

Which are the two correct structures?

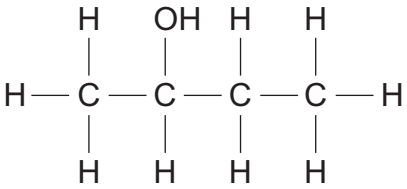
1



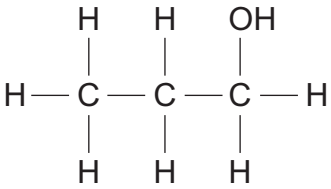
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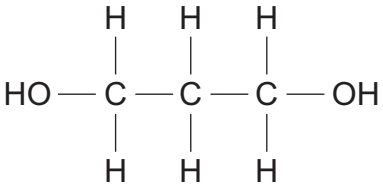
2



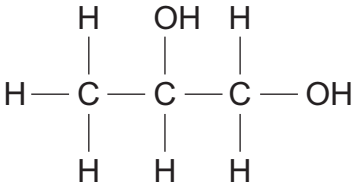
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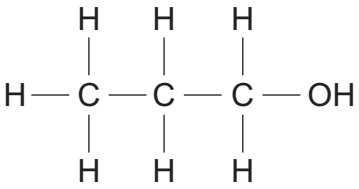
3



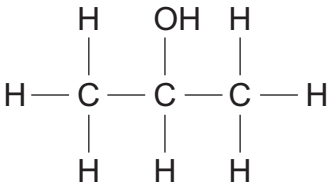
and



4



and



6D What are the likely products from burning in air an alcohol with a value of n = 8?

1 carbon dioxide and water only

2 carbon dioxide, carbon particles and water

3 carbon dioxide and carbon particles

4 carbon dioxide, sulfur dioxide and water

Turn over for the next question

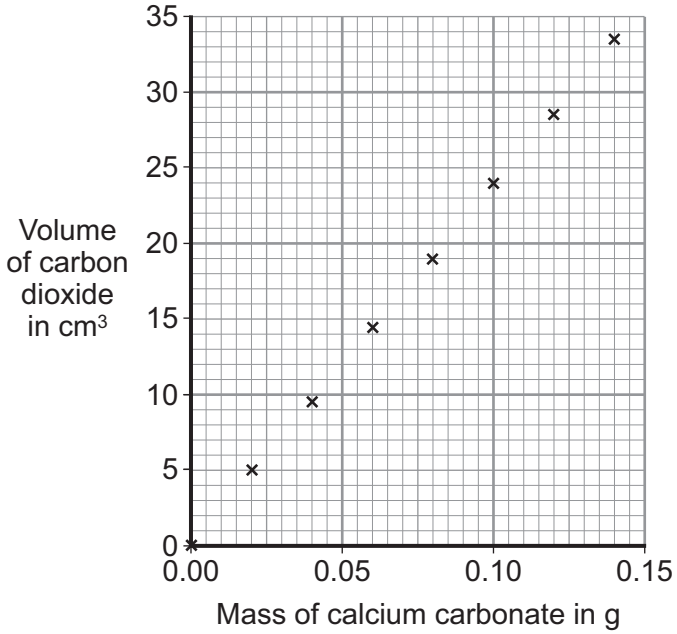
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QUESTION SEVEN

When calcium carbonate is heated it decomposes, forming calcium oxide and carbon dioxide.

calcium carbonate	→	calcium oxide	+	carbon dioxide
$CaCO_3$		CaO		CO_2

A student investigated how the quantity of carbon dioxide produced varies with the quantity of calcium carbonate that decomposes. The graph shows the results of the investigation.



7A What conclusion can be correctly drawn from these results?

1 The volume of carbon dioxide is independent of the mass of calcium carbonate.

2 The volume of carbon dioxide is directly proportional to the mass of calcium carbonate.

3 The volume of carbon dioxide is indirectly proportional to the mass of calcium carbonate.

4 There is no relationship between the volume of carbon dioxide and the mass of calcium carbonate.

7B The student repeated the investigation using the same masses of an impure sample of calcium carbonate. This sample contained 10 % of a substance that did not decompose on heating.

Which one of the following would describe the graph obtained?

1 a straight line that then levels off at just over 0.1 g of calcium carbonate

2 a straight line that has a gradient that is 10 % steeper throughout the whole range

3 a curved line that increases by 10 % for each point on the graph

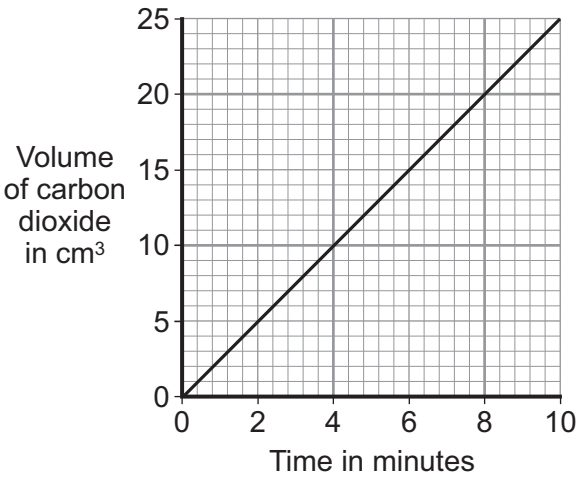
4 a straight line with a gradient that is less than the original sample

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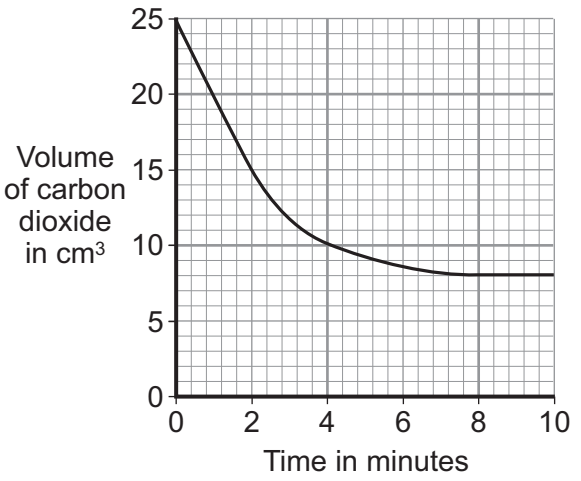
7C The student repeated the first experiment using 0.1g of calcium carbonate and measured the volume of carbon dioxide produced every minute until the reaction had finished.

Which of the following graphs could the student's results produce?

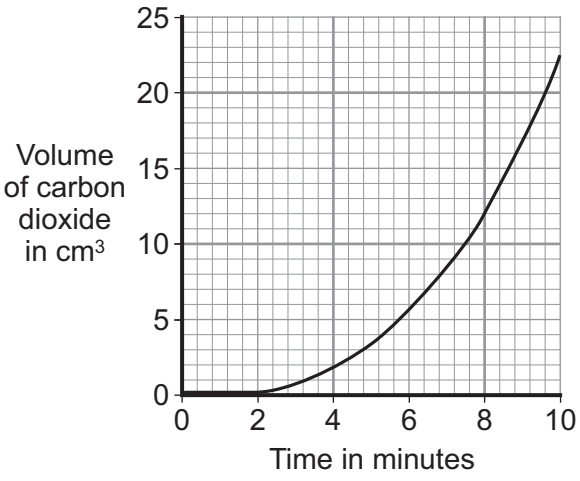
1



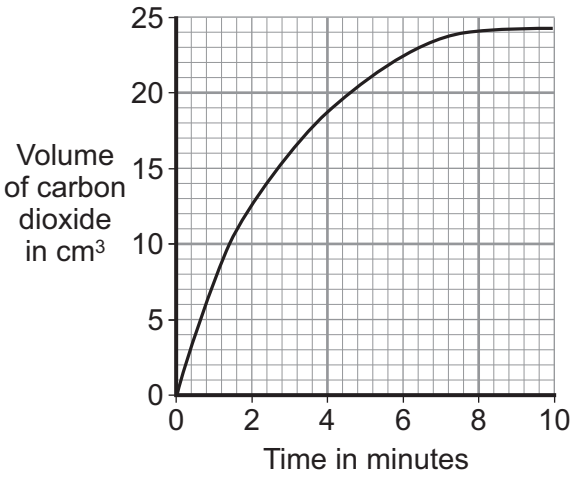
2



3



4



7D 5.0 grams of sodium carbonate were heated in a Bunsen burner flame.

There was no loss in mass after heating for 3 minutes.

A correct conclusion that can be drawn from this information is that . . .

1 sodium carbonate would decompose if heated for longer than 3 minutes.

2 sodium carbonate decomposes only at higher temperatures.

3 the mass of sodium oxide produced was equal to the mass of sodium carbonate heated.

4 sodium carbonate does **not** decompose at Bunsen burner temperatures.

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QUESTION EIGHT

Zinc is a reactive metal that will react with oxygen at high temperatures. Its two main ores are zinc sulfide (ZnS) and zinc carbonate ($ZnCO_3$). The relative abundance of each ore is about the same throughout the world.

To extract zinc, the ores are first heated to produce zinc oxide:

$$2ZnS + 3O_2 \xrightarrow{\text{heat}} 2ZnO + 2SO_2$$

$$ZnCO_3 \xrightarrow{\text{heat}} ZnO + CO_2$$

The zinc oxide is mixed with carbon (C) and heated in a furnace.

In the furnace, these reactions occur:

$$C + O_2(air) \xrightarrow{\text{heat}} CO_2$$

$$CO_2 + C \longrightarrow 2CO$$

Zinc is extracted by the following reaction:

$$ZnO + CO \longrightarrow Zn + CO_2$$

8A An advantage of using zinc carbonate instead of zinc sulfide is that. . .

1 zinc carbonate is more common and therefore cheaper.

2 only one waste product is formed.

3 less zinc is lost during the reaction.

4 zinc is formed directly without another chemical being used.

8B The atmosphere inside the furnace is kept rich in carbon monoxide (CO).

This is to . . .

1 prevent zinc oxide from reacting with carbon (C).

2 stop the zinc from re-forming zinc oxide.

3 remove carbon (C) from the furnace.

4 make carbon dioxide (CO_2).

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8C Zinc ores also contain lead compounds. Lead is produced with the zinc in the furnace. The temperature inside the furnace is about 1500 °C.

	Boiling point in °C	Density in g per cm^3	Reactivity
Lead	1749	11.3	Low
Zinc	907	7.1	High

Pure zinc is obtained from the furnace because . . .

1 zinc leaves the furnace as vapour, and liquid lead remains in the furnace.

2 liquid zinc floats on liquid lead in the furnace.

3 lead leaves the furnace as vapour, and liquid zinc remains in the furnace.

4 lead is more reactive than zinc and reacts with oxygen to form lead oxide.

8D Limestone is added to the furnace because . . .

1 it provides energy for the reaction.

2 it removes any acidic impurities.

3 it is the only source of the carbon dioxide in the furnace.

4 it is thermally stable.

Turn over for the next question

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QUESTION NINE

Haloalkanes are alkanes which have one or more hydrogen atoms replaced by halogen atoms.

The table shows properties of some haloalkanes.

Haloalkane	Formula	Density in g per cm^3	Boiling point in °C
Chloromethane	CH_3Cl	0.916	- 24.1
Bromomethane	CH_3Br	1.676	3.7
Iodomethane	CH_3I	2.279	42.5
Chloroethane	CH_3CH_2Cl	0.898	12.4
Bromoethane	CH_3CH_2Br	1.461	38.5
Iodoethane	CH_3CH_2I	1.936	72.4
Dichloromethane	CH_2Cl_2	1.30	40.1
Trichloromethane	$CHCl_3$	1.50	61.8

9A From the information in the table, increasing the length of the carbon chain . . .

1 increases density but decreases boiling point.

2 increases density and boiling point.

3 decreases density but increases boiling point.

4 decreases density and boiling point.

9B From the information in the table, replacing more hydrogen atoms with halogen atoms causes . . .

1 no effect on the boiling point or the density.

2 an increase in boiling point and density.

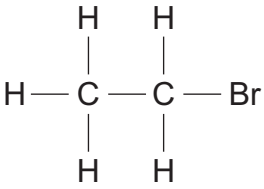
3 an increase in boiling point only.

4 an increase in density only.

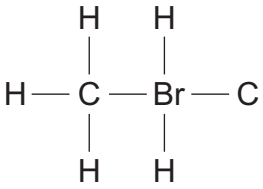
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9C Which is the correct structural formula for bromoethane?

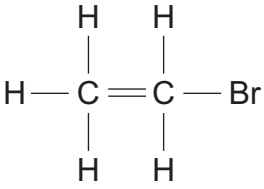
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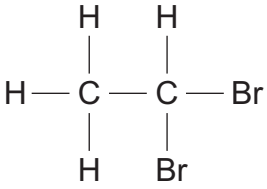
2



3



4



9D The order of the halogens in Group 7 of the periodic table is shown.

Group 7
Fluorine (F)
Chlorine (Cl)
Bromine (Br)
Iodine (I)

Which row in the table below shows the properties that fluoromethane might have?

	Density in g per cm^3	**Boiling point in ºC**
1	0.6	15
2	1.8	–100
3	1.1	–30
4	0.6	–80

END OF TEST

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Version 1.0: 01/04/2011

GCSE

Science A (4461) / Chemistry (4421)

Specification A

CHY1AP, CH1ASF & CH1ASH

Mark Scheme

2011 Examination – March Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

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GCSE

SCIENCE A (4461) / CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

March 2011

Foundation Tier

Question	Key		
One	**A**	Aluminium	**3**
	B	Calcium	**4**
	C	Copper	**2**
	D	Iron	**1**
Two	**A**	Quarrying leads to loss of habitat plus increased . . .	**4**
	B	Quarrying provides much needed jobs.	**3**
	C	Quarrying satisfies society's need for limestone and its products.	**2**
	D	Lakes, climbing walls and picnic areas can be created . . .	**1**
Three	**A**	Carbon	**1**
	B	Gold	**2**
	C	Magnesium	**4**
	D	Zinc	**3**
Four	**A**	Ethane	**1**
	B	Pentane	**3**
	C	Hexane	**4**
	D	Dodecane	**2**
Five	**A**	Carbon monoxide (CO) / Substance **A**	**4**
	B	Hydrogen (H_2) / Substance **B**	**2**
	C	Methane (CH_4) / Substance **C**	**1**
	D	Hydrogen sulfide (H_2S) / Substance **D**	**3**

	A	**B**	**C**	**D**
Six	**2**	**4**	**1**	**3**
Seven	**4**	**2**	**2**	**4**
Eight	**1**	**2**	**1**	**4**
Nine	**4**	**3**	**2**	**2**

GCSE

SCIENCE A (4461) / CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

March 2011

Higher Tier

Question	Key		
One	**A**	Carbon monoxide (CO) / Substance **A**	**4**
	B	Hydrogen (H_2) / Substance **B**	**2**
	C	Methane (CH_4) / Substance **C**	**1**
	D	Hydrogen sulfide (H_2S) / Substance **D**	**3**
Two	**A**	Metal **A**	**2**
	B	Metal **B**	**3**
	C	Metal **C**	**4**
	D	Metal **D**	**1**

	A	**B**	**C**	**D**
Three	**1**	**2**	**1**	**4**
Four	**4**	**3**	**2**	**2**
Five	**4**	**3**	**2**	**1**
Six	**3**	**1**	**4**	**2**
Seven	**2**	**4**	**4**	**4**
Eight	**2**	**2**	**1**	**2**
Nine	**3**	**2**	**1**	**4**

AQA

Unit : CHY1AP **CHEMISTRY UNIT 1A**

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 3G11

02-MAR-11

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	Substance A	○	○	○	○
1B	Substance B	○	○	○	○
1C	Substance C	○	○	○	○
1D	Substance D	○	○	○	○

QUESTION TWO		1	2	3	4
2A	Metal A	○	○	○	○
2B	Metal B	○	○	○	○
2C	Metal C	○	○	○	○
2D	Metal D	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A Aluminium	○	○	○	○
1B Calcium	○	○	○	○
1C Copper	○	○	○	○
1D Iron	○	○	○	○

QUESTION TWO	1	2	3	4
2A Quarrying leads to loss of habitat plus increased...	○	○	○	○
2B Quarrying provides much needed jobs.	○	○	○	○
2C Quarrying satisfies society's need for limestone and...	○	○	○	○
2D Lakes, climbing walls and picnic areas can be created...	○	○	○	○

QUESTION THREE	1	2	3	4
3A Carbon	○	○	○	○
3B Gold	○	○	○	○
3C Magnesium	○	○	○	○
3D Zinc	○	○	○	○

QUESTION FOUR	1	2	3	4
4A Ethane	○	○	○	○
4B Pentane	○	○	○	○
4C Hexane	○	○	○	○
4D Dodecane	○	○	○	○

QUESTION FIVE	1	2	3	4
5A Substance A	○	○	○	○
5B Substance B	○	○	○	○
5C Substance C	○	○	○	○
5D Substance D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
November 2010

Science A

Unit Chemistry C1a (Products from Rocks)

Chemistry

Unit Chemistry C1a (Products from Rocks)

CHY1AP

F&H

Thursday 11 November 2010 Afternoon Session

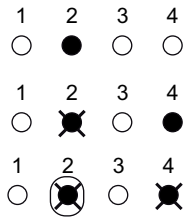
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 12 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

The table shows some information about four metals, **A**, **B**, **C** and **D**.

	Metal	Date of discovery	Boiling point in °C	Position in reactivity series
A	Iron	Before 1200	2900	Middle
B	Aluminium	1827	2640	High
C	Copper	Before 1200	2570	Low
D	Calcium	1808	1480	High

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

1	It is alloyed with carbon to make steel.
2	It was the last to be discovered.
3	It has the lowest boiling point.
4	It is the one most likely to be found as the metal itself.

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QUESTION TWO

The following report appeared in a village newspaper.

Stoneface Quarrying Company

The company plans to re-open a limestone quarry near the village.
The quarry has not been used for 15 years.
There is now a large pond at the bottom of the quarry.
The quarry is a protected habitat for wildlife.
The pond will be filled in when work begins.
Everyone is invited to come to a public meeting to discuss the re-opening of the quarry.

Match the outcomes of re-opening the quarry, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A will benefit the quarry owners

B will benefit people living close to the quarry

C will cause problems for the quarry owners

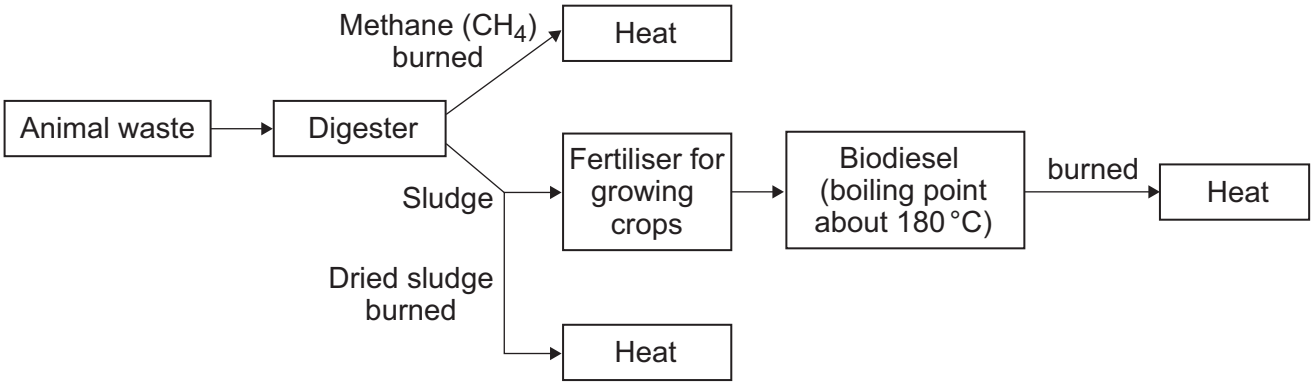
D will cause problems for local people

1	Workers will be needed at the quarry.
2	More lorries will be travelling through the village.
3	A protected wildlife habitat will be destroyed.
4	There is a big demand for limestone from many different industries.

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QUESTION THREE

The diagram shows how animal waste can be used to produce heat.



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

A Biodiesel

B Methane

C Animal waste

D Dried sludge

1	This substance is the raw material for the process.
2	This fuel is a gas.
3	This fuel is a liquid.
4	This fuel is a solid.

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QUESTION FOUR

The substances that we get from the distillation of crude oil have a range of properties.

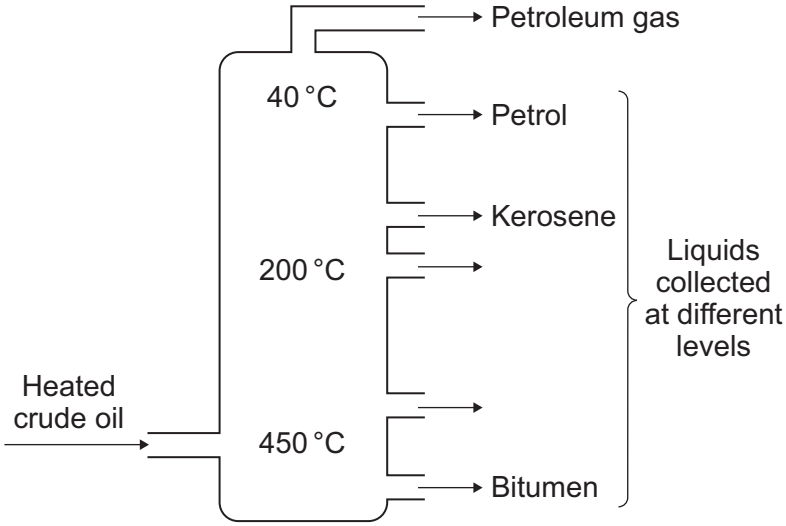
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A kerosene

B petroleum gas

C petrol

D bitumen



The substance with the lowest boiling point is . . . **1** . . . .

The substance collected at about 150 °C is . . . **2** . . . .

The most volatile liquid collected is . . . **3** . . . .

The most viscous substance collected is . . . **4** . . . .

QUESTION FIVE

This question is about how we obtain some metals.

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

A uses another metal

B does **not** use a chemical reaction

C could be done in a blast furnace

D is called electrolysis

1	Aluminium is made when an electric current passes through a molten aluminium compound.
2	Gold can be found at the bottom of some streams.
3	Titanium is made by reacting titanium chloride with magnesium.
4	Zinc is made when a mixture of zinc oxide and carbon is heated.

Turn over ▶

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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

Limestone is used for building. Acid rain can damage limestone buildings because limestone is mainly calcium carbonate. Calcium carbonate reacts with acid rain to produce carbon dioxide.

A scientist tests limestone with an acid rain solution to see how much damage occurs.

The scientist:

- weighed a piece of limestone
- put the limestone in the acid rain solution
- after 1 day, took the piece of limestone out of the solution and dried the surface
- reweighed the piece of limestone.

The scientist repeated this process with the same piece of limestone for 10 days.

The results are shown in the table.

Time in days	0	1	2	3	4	5	6	7	8	9	10
Mass in g	10.0	10.2	9.5	8.9	8.4	8.0	7.7	7.5	7.3	7.3	7.3

6A A gas that causes acid rain is . . .

1 carbon monoxide.

2 sulfur dioxide.

3 carbon dioxide.

4 nitrogen.

6B The mass of the piece of limestone increased during the first day because . . .

1 carbon dioxide was produced.

2 the acid was diluted with water.

3 the limestone soaked up some of the acid rain solution.

4 the substances were mixed.

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6C The mass of the piece of limestone decreased during the 10 days because . . .

1 there was an error using the balance.

2 carbon dioxide was given off.

3 the acid rain had been absorbed.

4 all the calcium carbonate had reacted.

6D After 11 days, the mass of the piece of limestone would be . . .

1 10.0 g.

2 8.4 g.

3 7.3 g.

4 6.5 g.

Turn over for the next question

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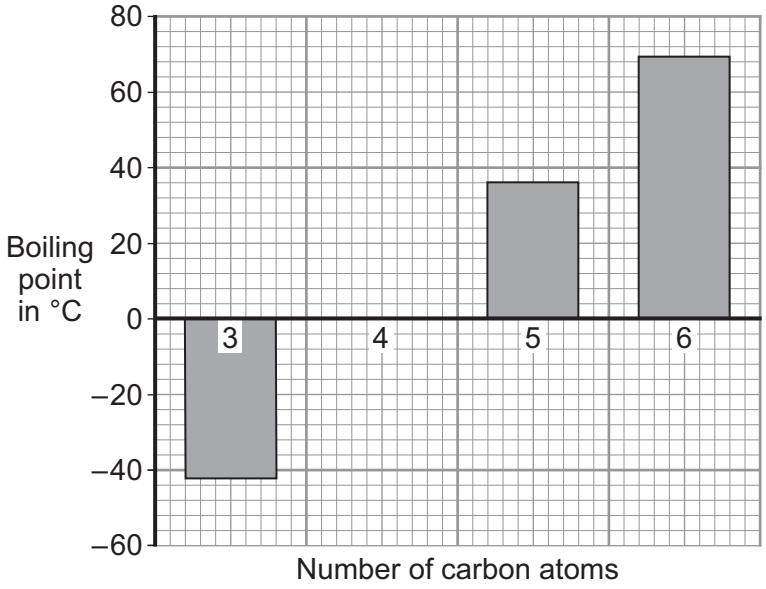
QUESTION SEVEN

This question is about alkanes with 3, 4, 5 or 6 carbon atoms in their molecules.

The table shows the boiling points of these four alkanes.

Number of carbon atoms in a molecule of the alkane	3	4	5	6
Boiling point in °C	–42	0	36	69

The data in the table can also be shown in the diagram below.



7A The diagram shows the data as a . . .

1 bar chart.

2 line graph.

3 pie chart.

4 scattergram.

7B The alkane with the highest boiling point has . . .

1 3 carbon atoms.

2 4 carbon atoms.

3 5 carbon atoms.

4 6 carbon atoms.

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7C The alkane with 4 carbon atoms does not seem to be shown on the diagram.

This is because . . .

1 this is an anomalous result.

2 this alkane contains only hydrogen.

3 the boiling point of this alkane is 0 °C.

4 this alkane has the lowest boiling point.

7D The data shows that as the number of carbon atoms . . .

1 increases, the boiling point decreases.

2 decreases, the boiling point decreases.

3 increases, the boiling point stays the same.

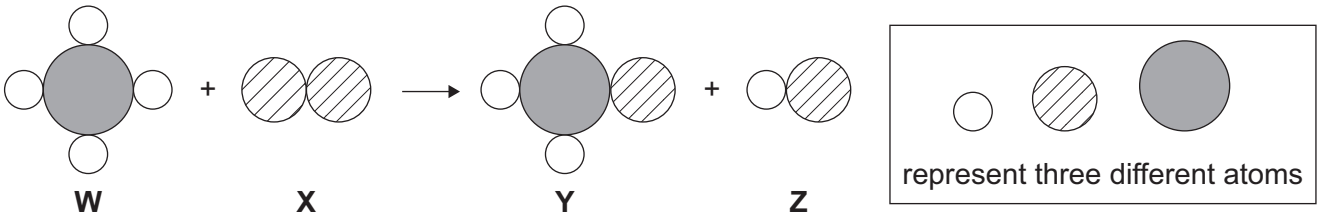
4 decreases, the boiling point stays the same.

Turn over for the next question

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QUESTION EIGHT

The diagram shows the reaction between substances **W** and **X** to produce two new substances **Y** and **Z**.



W **X** **Y** **Z**

8A Which statement about substance **Y** is correct?

1 It is a mixture of **W** and **X**.

2 It will have the same chemical properties as **W**.

3 It is a compound.

4 It has a total of 3 atoms.

8B In the formation of substances **Y** and **Z** from substances **W** and **X**, which statement is correct?

1 There is a decrease in mass.

2 There is an increase in mass.

3 No new chemical bonds are formed.

4 There is sharing or transfer of electrons.

8C Which substance would be found in the periodic table?

1 substance **W**

2 substance **X**

3 substance **Y**

4 substance **Z**

8D Which of the following statements is correct?

1 The total number of atoms stays the same during the reaction.

2 The reaction is an example of thermal decomposition.

3 Only atoms in substance **X** contain a nucleus.

4 Substance **W** contains five different elements.

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QUESTION NINE

Aluminium is extracted from a substance called bauxite. Bauxite contains aluminium oxide and impurities such as sand. Bauxite is first purified to make pure aluminium oxide. Then electricity is passed through the molten aluminium oxide. The molten aluminium oxide splits to make aluminium and oxygen.

9A Bauxite is an example of . . .

1 an element.

2 a compound.

3 an ore.

4 a solution.

9B The process used to extract aluminium is . . .

1 thermal decomposition.

2 reduction.

3 corrosion.

4 distillation.

9C Aluminium **cannot** be extracted from aluminium oxide using carbon because . . .

1 aluminium is more reactive than carbon.

2 the density of aluminium is too low.

3 carbon is higher in the reactivity series than aluminium.

4 aluminium is covered in a layer of aluminium oxide.

9D Aluminium is often recycled.

Which one of the following is **not** a good reason to recycle aluminium?

1 Recycling is cheaper than extracting aluminium from bauxite.

2 Drinks cans must be made from aluminium.

3 Recycling reduces the amount of energy used to make aluminium.

4 Bauxite reserves will last longer.

END OF TEST

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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 how we obtain some metals.

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

A uses another metal

B does **not** use a chemical reaction

C could be done in a blast furnace

D is called electrolysis

1	Aluminium is made when an electric current passes through a molten aluminium compound.
2	Gold can be found at the bottom of some streams.
3	Titanium is made by reacting titanium chloride with magnesium.
4	Zinc is made when a mixture of zinc oxide and carbon is heated.

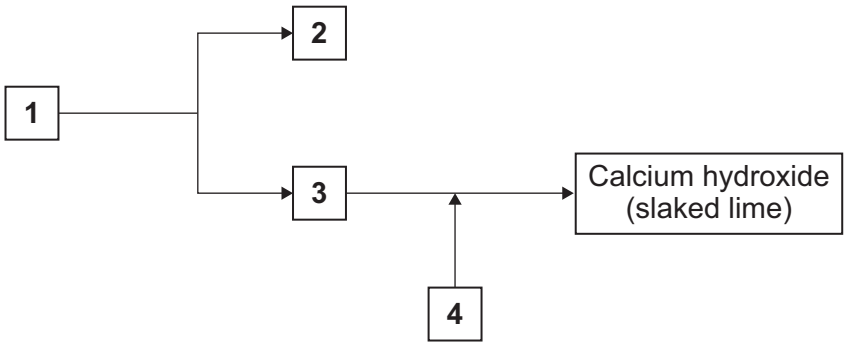
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QUESTION TWO

The equation for the reaction in a lime kiln is:

$$\underset{CaCO_3}{\text{calcium carbonate}} \longrightarrow \underset{CaO}{\text{calcium oxide}} + \underset{CO_2}{\text{carbon dioxide}}$$

The flow chart shows this reaction and a further reaction of one of the products.



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

A Water

B Calcium oxide

C Calcium carbonate

D Carbon dioxide

Turn over for the next question

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Section Two

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

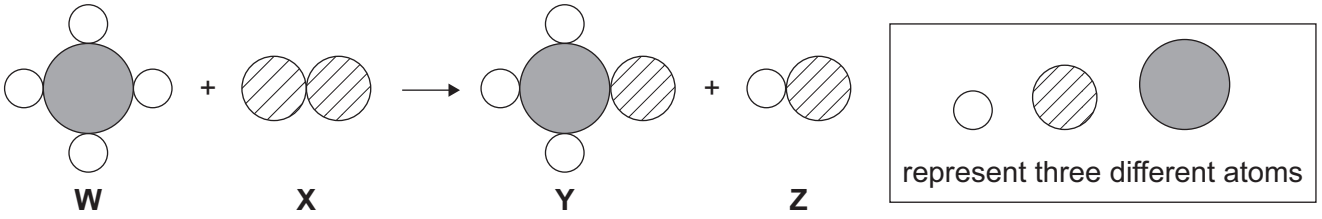
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION THREE

The diagram shows the reaction between substances **W** and **X** to produce two new substances **Y** and **Z**.



W **X** **Y** **Z**

3A Which statement about substance **Y** is correct?

1 It is a mixture of **W** and **X**.

2 It will have the same chemical properties as **W**.

3 It is a compound.

4 It has a total of 3 atoms.

3B In the formation of substances **Y** and **Z** from substances **W** and **X**, which statement is correct?

1 There is a decrease in mass.

2 There is an increase in mass.

3 No new chemical bonds are formed.

4 There is sharing or transfer of electrons.

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3C Which substance would be found in the periodic table?

1 substance **W**

2 substance **X**

3 substance **Y**

4 substance **Z**

3D Which of the following statements is correct?

1 The total number of atoms stays the same during the reaction.

2 The reaction is an example of thermal decomposition.

3 Only atoms in substance **X** contain a nucleus.

4 Substance **W** contains five different elements.

Turn over for the next question

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QUESTION FOUR

Aluminium is extracted from a substance called bauxite. Bauxite contains aluminium oxide and impurities such as sand. Bauxite is first purified to make pure aluminium oxide. Then electricity is passed through the molten aluminium oxide. The molten aluminium oxide splits to make aluminium and oxygen.

4A Bauxite is an example of . . .

1 an element.

2 a compound.

3 an ore.

4 a solution.

4B The process used to extract aluminium is . . .

1 thermal decomposition.

2 reduction.

3 corrosion.

4 distillation.

4C Aluminium **cannot** be extracted from aluminium oxide using carbon because . . .

1 aluminium is more reactive than carbon.

2 the density of aluminium is too low.

3 carbon is higher in the reactivity series than aluminium.

4 aluminium is covered in a layer of aluminium oxide.

4D Aluminium is often recycled.

Which one of the following is **not** a good reason to recycle aluminium?

1 Recycling is cheaper than extracting aluminium from bauxite.

2 Drinks cans must be made from aluminium.

3 Recycling reduces the amount of energy used to make aluminium.

4 Bauxite reserves will last longer.

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Turn over for the next question

QUESTION FIVE

Concrete is made when cement, sand, gravel and water are mixed together. The strength of concrete depends on how much cement is used in the mixture. Large buildings should be made of strong concrete. It is important that the concrete used for buildings has the correct strength.

In an experiment, different concrete mixtures were made up and allowed to set in a mould. The amount of cement added was varied, but the mix of sand, gravel and water was kept constant. The size of the mould was also kept the same.

The results of a series of tests are shown in the table.

		Strength in Newtons				
Concrete sample	**Percentage (%) of cement**	**Test 1**	**Test 2**	**Test 3**	**Test 4**	**Average**
1	5	100	110	105	105	105
2	10	120	130	125	125	125
3	15	160	160	120	160	160
4	20	180	180	180	165	
5	25	170	165	175	170	170
6	30	150	145	145	140	145

5A Which row in the table below is correct?

	The percentage (%) of cement is . . .	**The pattern in the results is best shown using a . . .**
1	an independent categoric variable	line graph
2	a dependent continuous variable	bar chart
3	an independent continuous variable	line graph
4	a dependent categoric variable	bar chart

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5B The average result for Concrete sample 4 is . . .

1 165 N.

2 176 N.

3 177 N.

4 180 N.

5C What is the best conclusion that can be made from the results in the table?

1 The strength of the concrete is directly proportioned to the percentage of cement.

2 The percentage of cement affects the strength of the concrete.

3 The concrete could be made stronger if steel rods were used for reinforcement.

4 Earthquakes cause weak buildings to fall down.

5D What is the best way to improve the reliability of the results of this experiment?

1 Use a range of sizes of moulds, and take an average of all the results.

2 Repeat the series of tests with different mixes of sand and gravel.

3 Repeat the same tests and compare the results.

4 Use equipment that can measure strength more accurately.

Turn over for the next question

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QUESTION SIX

The table shows the quantity of acidic gases produced in Britain, from different sources, between 1990 and 2004.

	Acidic gases produced in millions of tonnes			
Year	**Domestic**	**Transport and communications**	**Other industries**	**Total**
1990	0.75	0.75	5.40	6.90
1992	0.75	0.80	5.00	6.55
1994	0.70	0.80	4.10	5.60
1996	0.60	0.80	3.40	4.80
1998	0.50	0.85	2.90	4.25
2000	0.45	0.70	2.50	3.65
2002	0.40	0.85	2.15	3.40
2004	0.35	0.90	2.05	3.30

6A The decrease in the total amount of acidic gases produced between 1990 and 2004 is about . . .

1 5%.

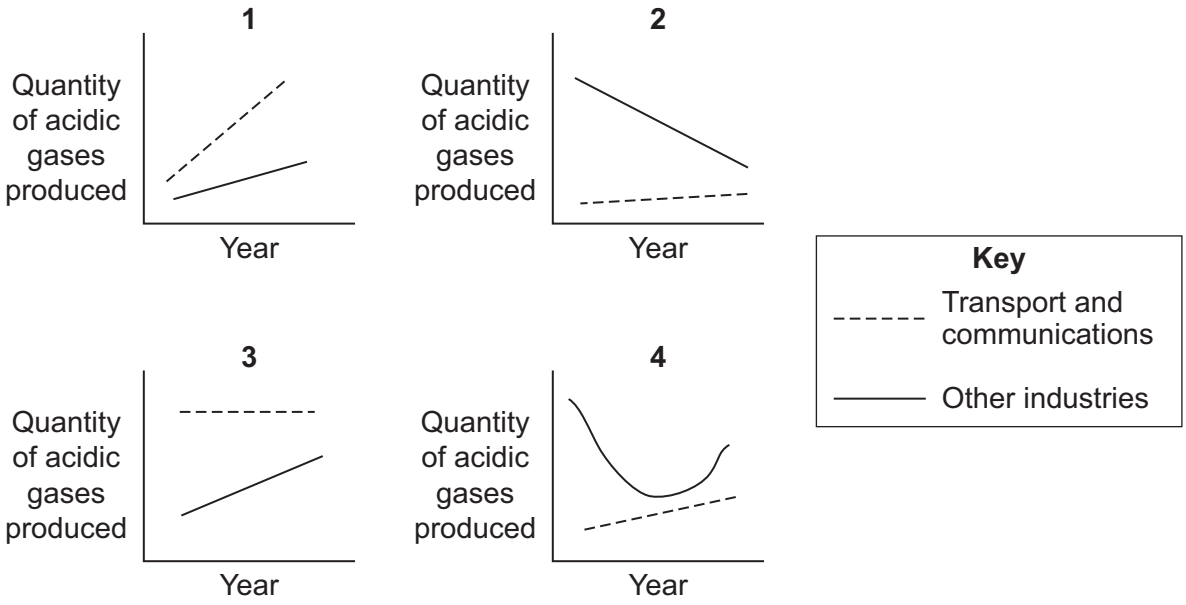
2 25%.

3 50%.

4 75%.

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6B Which graph correctly shows the data in the table for 'Transport and communications' and for 'Other industries'?



6C In 2000, 'Transport and communications' produced an unexpected amount of acidic gases, when compared to the trend in values.

Which one of the following could help to explain the unexpected amount of acidic gases produced?

1 a decrease in the number of aircraft flights

2 a decrease in the cost of crude oil

3 more traffic on the roads because of an increase in car production

4 more homes being built in the countryside

6D A catalytic converter in the exhaust system of vehicles can remove carbon monoxide and nitrogen dioxide. The two gases, carbon monoxide (CO) and nitrogen dioxide (NO_2), react to produce carbon dioxide (CO_2) and nitrogen (N_2).

The balanced equation that correctly describes this reaction is:

1 $CO + NO_2 \rightarrow CO_2 + N_2$

2 $2CO + NO_2 \rightarrow 2CO_2 + N_2$

3 $3CO + 2NO_2 \rightarrow 3CO_2 + N_2$

4 $4CO + 2NO_2 \rightarrow 4CO_2 + N_2$

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QUESTION SEVEN

This question is about crude oil and some of the alkanes that it contains.

The table shows information about four of the fractions obtained from the distillation of crude oil.

Fraction	Boiling point in °C	Number of carbon atoms in the molecules of the alkanes in the fraction
Gases	Lower than 25	1–4
Petrol	25–60	4–11
Naphtha	60–180	7–14
Kerosene	180–222	11–15

7A Which of the following is the likely boiling point for the alkane with twelve **hydrogen** atoms?

1 −16 °C

2 36 °C

3 76 °C

4 186 °C

7B Which of the following statements about the distillation of crude oil is correct?

1 It produces more alkanes than were in the original mixture.

2 It will not use up the world's fuel supplies.

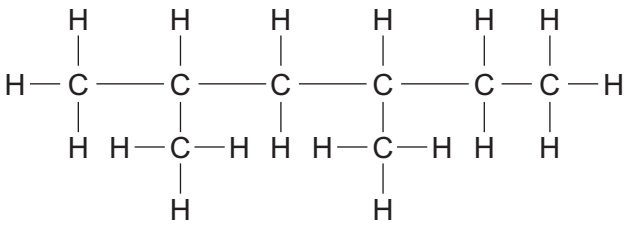
3 It will contribute to global warming.

4 It is a continuous process that could go on for ever.

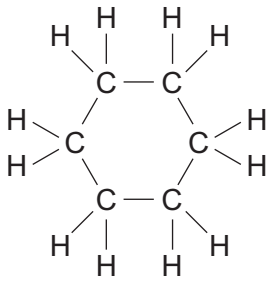
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7C Which of the following hydrocarbons would give the same number of molecules of carbon dioxide on complete combustion as octane C_8H_{18}?

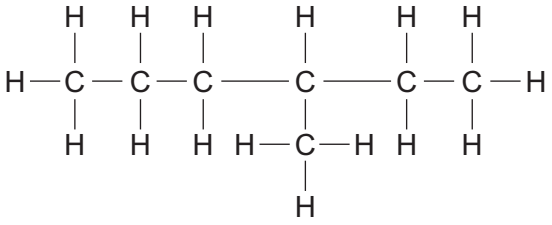
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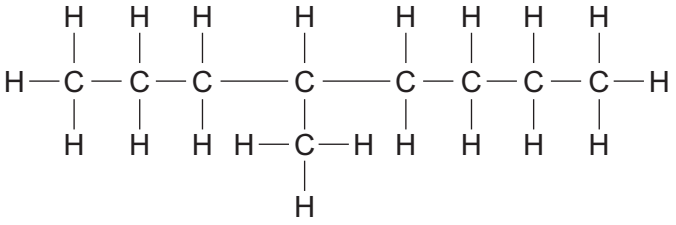
2



3



4



7D Hexane is the **sixth** member of the alkanes.

Which of the following could **not** be calculated from this information about its position in the alkane series?

1 its chemical formula

2 the number of water molecules produced by burning one molecule of hexane

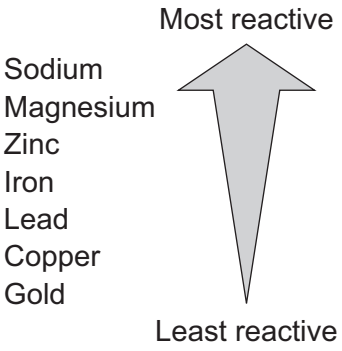
3 the number of bonds in one molecule of hexane

4 the number of carbon monoxide molecules produced by the incomplete combustion of one molecule of hexane

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QUESTION EIGHT

A metal will displace a less reactive metal from its compounds.



If a reaction occurs, it releases heat. The reactivity of metals can be investigated by measuring the temperature rise if a fair test is carried out between metals and metal compounds.

Metal	Metal compound	Temperature rise in °C
Zinc	Lead nitrate	10
Iron	Lead nitrate	6
Zinc	Copper sulfate	19
Magnesium	Copper sulfate	48
Copper	Zinc sulfate	0

8A The results in the table suggest that the largest rise in temperature occurs when . . .

1 a metal reacts with a metal compound that is a sulfate.

2 a transition metal is used with a metal compound.

3 there is a large difference in reactivity between the metal used and the metal in the metal compound.

4 a Group 1 metal reacts with a transition metal compound.

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8B Using copper and zinc sulfate does **not** cause a temperature rise.

This is because . . .

1 not enough copper is used.

2 zinc is more reactive than copper.

3 copper corrodes easily.

4 too much zinc sulfate is added.

8C Which of the following metals will cause the largest temperature rise when added to iron nitrate solution?

1 gold

2 sodium

3 lead

4 zinc

8D
- Carbon can reduce zinc oxide.
- Magnesium can react with carbon dioxide.
- Carbon can produce iron from iron oxide.

Where should carbon be placed in the reactivity series?

1 above magnesium but below sodium

2 above zinc but below magnesium

3 below iron but above lead

4 below lead but above copper

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QUESTION NINE

Anaesthetics are used to put people to sleep before operations.

Diethylether, $CH_3CH_2–O–CH_2CH_3$ was used as an anaesthetic. Unfortunately, diethylether is very flammable, and sunlight decomposes it into an explosive substance. Research was done to improve this anaesthetic. When halogen atoms replaced the hydrogen atoms, the compounds were much less explosive. The halogens used were fluorine (F), chlorine (Cl) and bromine (Br).

This research found the following:

- replacing the H atoms in diethylether with fluorine atoms (F) reduces the flammability
- the greater the number of different halogens, the greater the anaesthetic effect
- the more chlorine atoms, the greater the toxicity
- sunlight breaks down anaesthetics that contain C–Cl and C–Br bonds into toxic substances.

9A Which of the following is probably the most toxic anaesthetic?

1 $CH_3CHCl–O–CH_2CHCl_2$

2 $CH_3CH_2–O–CHFCFCl_2$

3 $CF_3CHCl–O–CH_2CHF_2$

4 $CF_3CH_2–O–CH_2CF_3$

9B Which of the following would probably have the greatest anaesthetic effect?

1 $CF_3CHF–O–CHClCF_3$

2 $CF_3CHCl–O–CH_2CBrF_2$

3 $CF_3CH_2–O–CH_2CCl_3$

4 $CF_3CH_2–O–CH_2CH_3$

9C Which is the only anaesthetic that would **not** have to be kept in a dark bottle?

1 $CH_3CH_2–O–CH_2CH_3$

2 $CH_3CHCl–O–CH_2CHF_2$

3 $CF_3CHF–O–CH_2CHF_2$

4 $CF_3CHCl–O–CHBrCHF_2$

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9D When a new anaesthetic has been made, what would have to be done first before the new anaesthetic could be used on patients?

1 find the accurate boiling point

2 estimate the cost of manufacturing the new anaesthetic

3 find the dosage needed to keep patients anaesthetised

4 conduct tests on toxicity

END OF TEST

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ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A (4461) / Chemistry (4421)

Specification A

CHY1AP, CH1ASF & CH1ASH

Mark Scheme

2010 Examination – November Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

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GCSE

SCIENCE A (4461) / CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

November 2010

Foundation Tier

Question	Key		
One	**A**	Iron	**1**
	B	Aluminium	**2**
	C	Copper	**4**
	D	Calcium	**3**
Two	**A**	will benefit the quarry owners	**4**
	B	will benefit people living close to the quarry	**1**
	C	will cause problems for the quarry owners	**3**
	D	will cause problems for local people	**2**
Three	**A**	Biodiesel	**3**
	B	Methane	**2**
	C	Animal waste	**1**
	D	Dried sludge	**4**
Four	**A**	kerosene	**2**
	B	petroleum gas	**1**
	C	petrol	**3**
	D	bitumen	**4**
Five	**A**	uses another metal	**3**
	B	does **not** use a chemical reaction	**2**
	C	could be done in a blast furnace	**4**
	D	is called electrolysis	**1**

	A	**B**	**C**	**D**
Six	**2**	**3**	**2**	**3**
Seven	**1**	**4**	**3**	**2**
Eight	**3**	**4**	**2**	**1**
Nine	**3**	**2**	**1**	**2**

GCSE

SCIENCE A (4461) / CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

November 2010

Higher Tier

Question	Key		
One	**A**	uses another metal	**3**
	B	does **not** use a chemical reaction	**2**
	C	could be done in a blast furnace	**4**
	D	is called electrolysis	**1**
Two	**A**	Water	**4**
	B	Calcium oxide	**3**
	C	Calcium carbonate	**1**
	D	Carbon dioxide	**2**

	A	B	C	D
Three	**3**	**4**	**2**	**1**
Four	**3**	**2**	**1**	**2**
Five	**3**	**4**	**2**	**3**
Six	**3**	**2**	**1**	**4**
Seven	**2**	**3**	**1**	**4**
Eight	**3**	**2**	**2**	**2**
Nine	**1**	**2**	**3**	**4**

AQA

Unit : CHY1AP CHEMISTRY UNIT 1A

Centre :

Candidate Number : **UCI :** Series : BG10

Candidate Name :

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	uses another metal	○	○	○	○
1B	does not use a chemical reaction	○	○	○	○
1C	could be done in a blast furnace	○	○	○	○
1D	is called electrolysis	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	Water	○	○	○	○
2B	Calcium oxide	○	○	○	○
2C	Calcium carbonate	○	○	○	○
2D	Carbon dioxide	○	○	○	○

QUESTION THREE

	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR

	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE

	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A Iron	○	○	○	○
1B Aluminium	○	○	○	○
1C Copper	○	○	○	○
1D Calcium	○	○	○	○

QUESTION TWO	1	2	3	4
2A will benefit the quarry owners	○	○	○	○
2B will benefit people living close to the quarry	○	○	○	○
2C will cause problems for the quarry owners	○	○	○	○
2D will cause problems for local people	○	○	○	○

QUESTION THREE	1	2	3	4
3A Biodiesel	○	○	○	○
3B Methane	○	○	○	○
3C Animal waste	○	○	○	○
3D Dried sludge	○	○	○	○

QUESTION FOUR	1	2	3	4
4A kerosene	○	○	○	○
4B petroleum gas	○	○	○	○
4C petrol	○	○	○	○
4D bitumen	○	○	○	○

QUESTION FIVE	1	2	3	4
5A uses another metal	○	○	○	○
5B does not use a chemical reaction	○	○	○	○
5C could be done in a blast furnace	○	○	○	○
5D is called electrolysis	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
June 2010

Science A

Unit Chemistry C1a (Products from Rocks)

Chemistry

Unit Chemistry C1a (Products from Rocks)

CHY1AP

F&H

Monday 28 June 2010 Morning Session

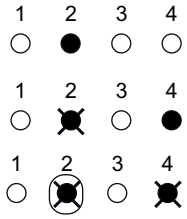
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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 12 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**.

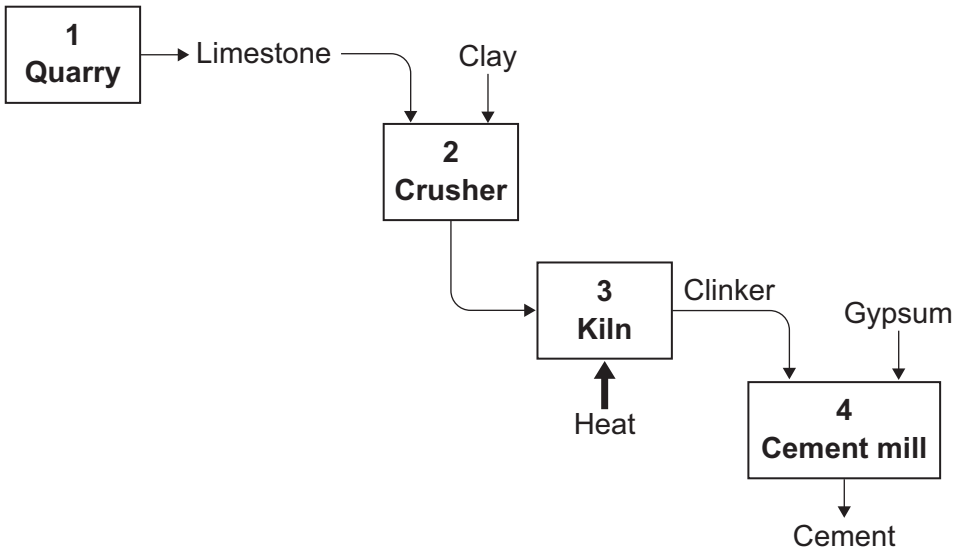
Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

Limestone, clay and gypsum are natural substances that can be quarried.

The flow chart shows how they are used to make cement.



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

A It is where thermal decomposition takes place.

B It is where only natural substances are mixed.

C It is where a natural substance is mixed with a man-made substance.

D It is where limestone is obtained.

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QUESTION TWO

The table shows the composition and melting points of four alloys, **A**, **B**, **C** and **D**.

Alloy	Melting point in °C	Percentage composition (%)				
		Tin	Indium	Bismuth*	Lead*	Cadmium*
A	100	24.0	0	49.0	27.0	0
B	62	16.5	51.0	32.5	0	0
C	70	13.0	0	50.0	27.0	10.0
D	47	8.3	19.1	44.7	22.6	5.3

Toxic substances are marked with *.

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

1 It has the highest melting point.

2 It is made up from the largest number of substances.

3 It contains the least bismuth.

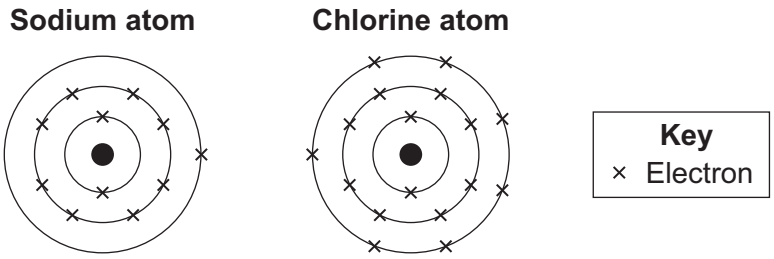
4 It contains the largest percentage of toxic substances.

Turn over for the next question

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QUESTION THREE

This question is about a sodium atom and a chlorine atom.



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

A bonds

B electrons

C elements

D nuclei

In the diagrams, ● represents . . . **1** . . . .

Sodium and chlorine are . . . **2** . . . .

When sodium and chlorine react, the chlorine atoms take . . . **3** . . . from the sodium atoms.

The sodium and chlorine atoms are then held together by . . . **4** . . . .

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QUESTION FOUR

The table shows information about four fuels, **A**, **B**, **C** and **D**.

	Fuel	Type of substance	Number of carbon atoms per molecule	Energy per g of fuel	Mass of carbon dioxide per g of fuel
A	LPG	Alkanes	3 or 4	50 kJ	3.0 g
B	Diesel	Alkanes	16–20	53 kJ	3.1 g
C	Ethanol	Alcohol	2	30 kJ	1.9 g
D	Hydrogen	Element	0	118 kJ	0.0 g

Match fuels, **A**, **B**, **C** and **D**, with the numbers **1–4**.

1 This fuel has the lowest boiling point of the fuels that are alkanes.

2 This fuel does not produce carbon dioxide when burned.

3 This fuel gives the least amount of energy per gram when burned.

4 This fuel has the most carbon atoms in its molecules.

QUESTION FIVE

Petrol is a hydrocarbon fuel that burns in air. Air is mainly nitrogen.

In a car engine:

- not all of the petrol burns completely
- after burning, the products pass into the exhaust pipe.

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

A nitrogen dioxide

B carbon monoxide

C carbon dioxide

D soot (carbon)

The black solid seen inside the exhaust pipe is . . . **1** . . . .

The gas in the exhaust fumes formed by the complete combustion of petrol is . . . **2** . . . .

The poisonous gas in the exhaust fumes formed by incomplete combustion of petrol is . . . **3** . . . .

The gas in the exhaust fumes formed by combining two gases from the air is . . . **4** . . . .

Turn over ▶

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Section Two

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

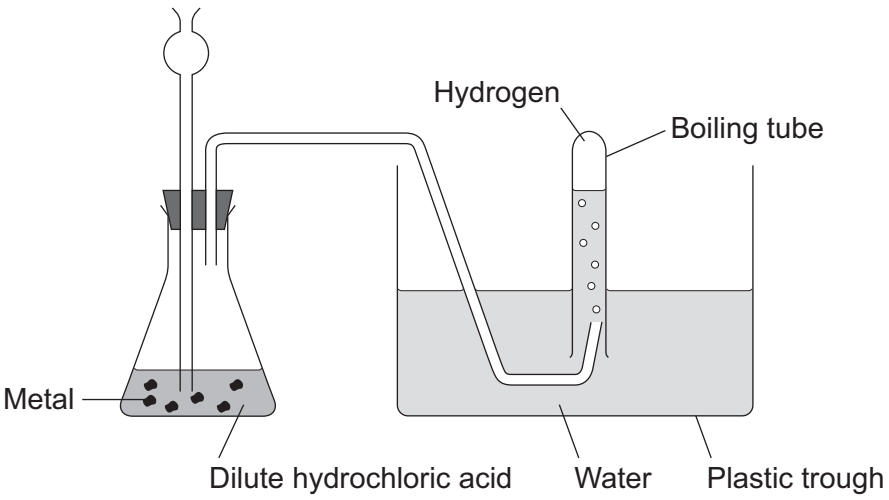
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

Some students were trying to decide which one of the metals, **K**, **L**, **M** or **N**, was the most reactive. They set up the apparatus shown in the diagram.



Dilute hydrochloric acid was added to the metal **K**. Hydrogen was given off. The students recorded how long it took to fill the boiling tube with the hydrogen. They did the experiment twice more under exactly the same conditions.

They repeated the experiment, using equal-sized pieces of metals **L**, **M** and **N**.

The results are shown in the table.

	Time taken to fill the boiling tube with hydrogen in seconds		
Metal	**Experiment 1**	**Experiment 2**	**Experiment 3**
K	600	479	649
L	189	220	178
M	81	82	78
N	125	132	143

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6A To make it a fair test, the students made sure that the boiling tube was always completely filled with hydrogen before they recorded the time.

What else should they do to make it a fair test?

1 use a different acid for each metal

2 use the same volume of the acid for each test

3 replace the water in the plastic trough for each test

4 use different temperatures for each metal

6B Which metal was the most reactive?

1 metal **K**

2 metal **L**

3 metal **M**

4 metal **N**

6C Why did the students take more than one reading for each metal?

1 to make an error less likely

2 so that they could plot a graph

3 to make it easier to see the relationship between the two variables

4 to make it a fair test

6D Some of their results were anomalous.

Which of the following experiments should the students repeat?

1 metal **K**, experiment 2

2 metal **L**, experiment 3

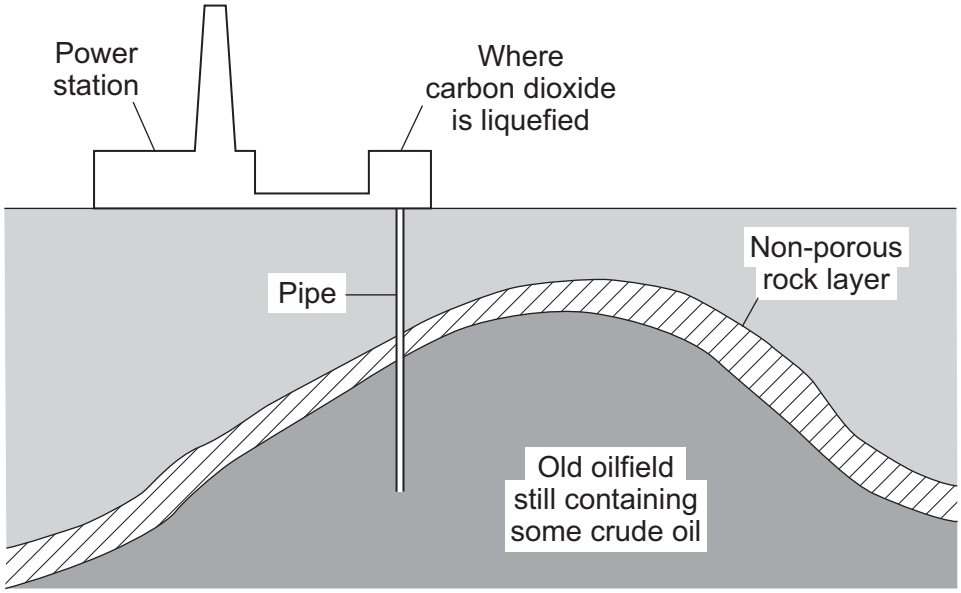
3 metal **M**, experiment 3

4 metal **N**, experiment 1

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QUESTION SEVEN

Carbon capture and storage (CCS) is being developed to reduce the amount of carbon dioxide released into the atmosphere by power stations. Carbon dioxide is separated from the waste gases. It is liquefied and then pumped into a storage area underground. There are many old oilfields that could be used as storage areas.



7A The main reason why CCS is being developed is . . .

1 to reduce global warming.

2 because old oilfields need filling up.

3 because carbon dioxide is toxic.

4 to store carbon dioxide for future use.

7B A possible additional benefit from CCS is that it . . .

1 stops crude oil from rising to the surface.

2 could help to extract any remaining crude oil.

3 prevents the formation of new crude oil.

4 stops the old oilfield from being used as a landfill site.

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7C The carbon dioxide does not re-enter the atmosphere from the old oilfield . . .

1 because of plants that grow deep underground.

2 because the pipe to the old oilfield is too narrow.

3 because of the non-porous rock layer.

4 because it turns into a fossil fuel.

7D Which of the following might be a problem for CCS?

1 The carbon dioxide is needed in the atmosphere.

2 There are no old oilfields left.

3 Nobody will be burning fossil fuels in the near future.

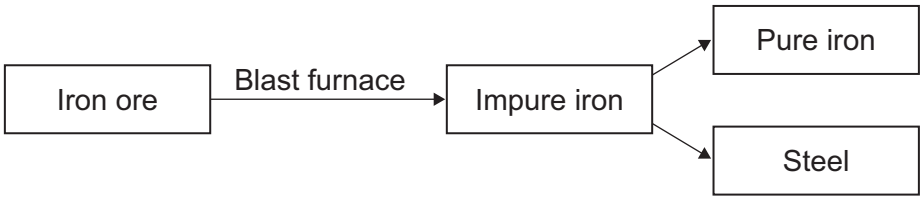
4 Earthquakes might occur in the old oilfields.

Turn over for the next question

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QUESTION EIGHT

The flow chart shows how iron ore can be changed into useful materials.



8A Iron ore is the starting material for making iron because . . .

1 iron ore is magnetic.

2 iron ore contains a reasonable amount of iron oxide.

3 a lot of energy is needed to convert iron ore into iron.

4 mining iron ore does not cause any environmental problems.

8B In the blast furnace, iron oxide is converted to iron using carbon. This is because . . .

1 iron is less reactive than carbon.

2 iron is more reactive than carbon.

3 carbon is a cheap material to use.

4 carbon combines with the metal impurities in the iron ore, leaving iron.

8C Impure iron is hard and brittle. This is because in impure iron . . .

1 the impurities distort the layers of atoms so they cannot slide over each other.

2 the carbon breaks up the iron structure, allowing it to bend easily.

3 its structure has been destroyed by heating to a very high temperature.

4 all the atoms are the same and so remain in a regular arrangement.

8D When impure iron is converted into steel, . . .

1 all the carbon is removed and not replaced.

2 the amount of carbon is carefully controlled.

3 all the metal impurities are removed and not replaced.

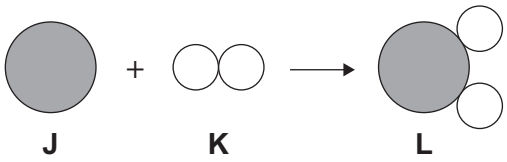
4 chromium is always added to the iron.

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QUESTION NINE

The diagram represents the reaction between substance **J** and substance **K** to create a new substance, **L**.

In the diagram, each circle represents an atom.



9A Which substance or substances are elements?

1 **J** only

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

3 both **J** and **K**

4 **L** only

9B Substance **L** . . .

1 is an impure substance.

2 is a mixture.

3 will have the same chemical properties as substances **J** and **K**.

4 is a compound of **J** and **K**.

9C When substance **L** is formed from substances **J** and **K** . . .

1 there is an overall increase in mass.

2 there is an overall decrease in mass.

3 there is no overall change in mass.

4 the total number of atoms changes.

9D A molecule of substance **K** will . . .

1 have two separate nuclei.

2 share a nucleus.

3 not have any chemical bonds.

4 not contain any electrons.

END OF TEST

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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

Petrol is a hydrocarbon fuel that burns in air. Air is mainly nitrogen.

In a car engine:

- not all of the petrol burns completely
- after burning, the products pass into the exhaust pipe.

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

A nitrogen dioxide

B carbon monoxide

C carbon dioxide

D soot (carbon)

The black solid seen inside the exhaust pipe is . . . **1** . . . .

The gas in the exhaust fumes formed by the complete combustion of petrol is . . . **2** . . . .

The poisonous gas in the exhaust fumes formed by incomplete combustion of petrol is . . . **3** . . . .

The gas in the exhaust fumes formed by combining two gases from the air is . . . **4** . . . .

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QUESTION TWO

This question is about the substances in this reaction:

$$Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$$

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

A C

B Fe

C CO

D Fe_2O_3

1	In the reaction, it is reduced.
2	It is a transition element.
3	In the reaction, it is oxidised.
4	It is formed by oxidation of a non-metal element.

Turn over for the next question

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Section Two

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

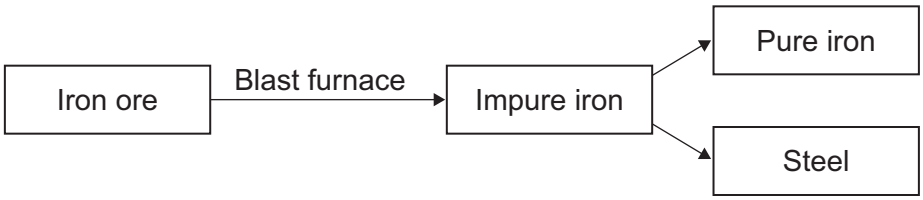
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION THREE

The flow chart shows how iron ore can be changed into useful materials.



3A Iron ore is the starting material for making iron because . . .

1 iron ore is magnetic.

2 iron ore contains a reasonable amount of iron oxide.

3 a lot of energy is needed to convert iron ore into iron.

4 mining iron ore does not cause any environmental problems.

3B In the blast furnace, iron oxide is converted to iron using carbon. This is because . . .

1 iron is less reactive than carbon.

2 iron is more reactive than carbon.

3 carbon is a cheap material to use.

4 carbon combines with the metal impurities in the iron ore, leaving iron.

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3C Impure iron is hard and brittle. This is because in impure iron . . .

1 the impurities distort the layers of atoms so they cannot slide over each other.

2 the carbon breaks up the iron structure, allowing it to bend easily.

3 its structure has been destroyed by heating to a very high temperature.

4 all the atoms are the same and so remain in a regular arrangement.

3D When impure iron is converted into steel, . . .

1 all the carbon is removed and not replaced.

2 the amount of carbon is carefully controlled.

3 all the metal impurities are removed and not replaced.

4 chromium is always added to the iron.

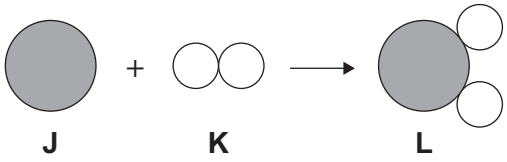
Turn over for the next question

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QUESTION FOUR

The diagram represents the reaction between substance **J** and substance **K** to create a new substance, **L**.

In the diagram, each circle represents an atom.



4A Which substance or substances are elements?

1 **J** only

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

3 both **J** and **K**

4 **L** only

4B Substance **L** . . .

1 is an impure substance.

2 is a mixture.

3 will have the same chemical properties as substances **J** and **K**.

4 is a compound of **J** and **K**.

4C When substance **L** is formed from substances **J** and **K** . . .

1 there is an overall increase in mass.

2 there is an overall decrease in mass.

3 there is no overall change in mass.

4 the total number of atoms changes.

4D A molecule of substance **K** will . . .

1 have two separate nuclei.

2 share a nucleus.

3 not have any chemical bonds.

4 not contain any electrons.

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Turn over for the next question

QUESTION FIVE

Limestone varies in its composition. Most limestone from Derbyshire is almost pure calcium carbonate, but dolomitic limestone contains both calcium carbonate and magnesium carbonate.

Limestone is quarried because it can be:

- cut into blocks and used for buildings
- thermally decomposed to make other materials.

5A One possible way of conserving the world's supply of limestone is to . . .

1 use more dolomitic limestone instead of limestone from Derbyshire.

2 allow quarry workers to work more hours per day.

3 recycle the limestone used in buildings.

4 re-open old limestone quarries.

5B The mineral dolomite has the formula $CaCO_3.MgCO_3$

This means that the formula contains . . .

1 as many metallic elements as non-metallic elements.

2 a total of eight atoms.

3 a total of four metal atoms.

4 six different elements.

Metal carbonates decompose at different temperatures.

- Calcium carbonate decomposes at 900 °C.
- Magnesium carbonate decomposes at 540 °C.

5C Which substances would be formed if dolomitic limestone was heated at 700 °C?

1 magnesium oxide and carbon dioxide

2 calcium oxide and carbon dioxide

3 magnesium oxide, calcium oxide and carbon dioxide

4 magnesium oxide, calcium oxide and carbon monoxide

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5D An advantage of using dolomitic limestone instead of limestone from Derbyshire is that dolomitic limestone . . .

1 is completely decomposed at lower temperatures.

2 produces more products on decomposition.

3 is more easily quarried.

4 produces fewer gases on decomposition.

Turn over for the next question

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QUESTION SIX

Mortar is made by mixing cement, sand and water, and then leaving it to set hard.

A student investigated the effect of changing the cement content on the strength of mortar.

- She made 8 blocks of mortar, one for each of the mixtures of cement and sand shown in the table.
- After 48 hours, she measured the force needed to break each solid block.

The results are shown in the table below.

Mass of cement in g	Mass of sand in g	Breaking force in N
17.5	50.0	11.7
20.0	50.0	15.2
22.5	50.0	18.7
25.0	50.0	22.2
27.5	50.0	25.7
30.0	50.0	29.2
32.5	50.0	31.7
35.0	50.0	33.2

6A The student tried to make the experiment a fair test.

Which row in the table below explains what she did, and what else she should have done?

	Steps taken by student	Extra steps needed
1	Equal volumes of water and equal setting time	Repeat the experiments several times and work out averages
2	Equal mass of cement and equal setting time	Equal size blocks and equal volumes of water
3	Equal mass of sand and equal setting time	Equal size blocks and equal volumes of water
4	Repeat the experiment several times for each mixture and work out averages	Equal size blocks and equal setting time

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6B Which row in the table below gives a correct description of the breaking force and the best way to show the results of the experiment?

	Breaking force	Best way to show results
1	A dependent, categoric variable	Bar chart
2	An independent, continuous variable	Line graph
3	An independent, categoric variable	Scattergram
4	A dependent, continuous variable	Line graph

6C A correct conclusion that can be made from the results is that the strength of the mortar . . .

1 is directly proportional to the mass of cement used.

2 is greater if the amount of cement used is increased.

3 could be increased by using fibres in the mixture.

4 would be reduced by using more water.

6D What conclusion might the student have made if she had stopped after her first six measurements?

1 The breaking force halves when the mass of cement doubles.

2 The breaking force decreases as the mass of cement increases.

3 Bars containing no sand would be the strongest.

4 The breaking force increases linearly with the mass of cement.

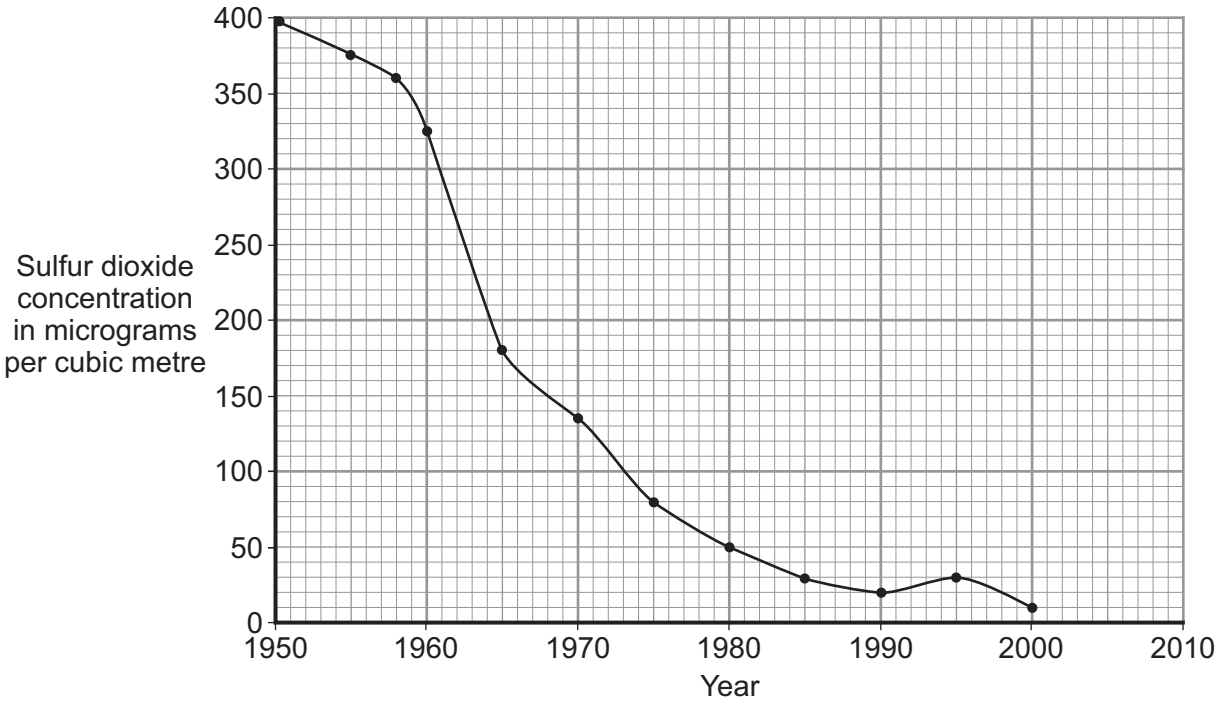
Turn over for the next question

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QUESTION SEVEN

The graph shows how sulfur dioxide concentrations in the atmosphere above London changed between 1950 and 2000.

The table shows the energy used in London in 1950 and in 2000.



Year	Energy used in arbitrary units							
	Petrol	Diesel	Electricity	Oil	House coal	Other solid fuels	Gas	Total
1950	10	5	20	25	100	110	60	330
2000	60	20	130	10	0	10	310	540

7A The information in the graph and table suggests that sulfur dioxide levels have decreased due to . . .

1 an increase in the use of petrol.

2 a decrease in the use of coal and other solid fuels.

3 an increase in the use of electricity that is generated at coal-burning power stations.

4 an increase in the use of diesel.

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7B Which one of the following is a reason why a prediction for sulfur dioxide concentration in 2010 might be unreliable?

1 Sulfur dioxide has a natural cycle in London of increasing and decreasing.

2 Sulfur dioxide dissolves in water to produce acid rain.

3 The concentration of sulfur dioxide has, in previous years, both increased and decreased.

4 Sulfur dioxide is very difficult to measure in such small concentrations.

7C It was found that the amount of sulfur dioxide from transport increased during years 2000 to 2004, even though many more cars were using low-sulfur fuels.

The reason for this could be . . .

1 a decrease in the use of transport.

2 the introduction of more efficient cars that burn less fuel.

3 an increase in the number of cars used in London.

4 an increase in the price of crude oil.

7D A newspaper published an article about sulfur dioxide concentrations in the atmosphere above London. It stated that in one five-year period, sulfur dioxide levels had fallen by about 44 %.

The five-year period was . . .

1 1960 – 1965.

2 1965 – 1970.

3 1985 – 1990.

4 1995 – 2000.

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QUESTION EIGHT

The table gives some data on four alkanes.

Name of alkane	Formula of alkane	Melting point in °C	Boiling point in °C	Amount of oxygen in cm^3 needed to completely burn 100 cm^3 of the alkane	Amount of air in cm^3 needed to completely burn 100 cm^3 of the alkane
Methane	CH_4	−182	−164	200	1000
Ethane	C_2H_6	−183	−89	350	1750
Propane	C_3H_8	−190	−42	500	2500
Butane	C_4H_{10}	−138	−1	650	3250

8A Petroleum gas contains the four alkanes in the table.

Which statement correctly describes what happens if petroleum gas is cooled?

1 By cooling to –150 °C, only methane would turn to liquid.

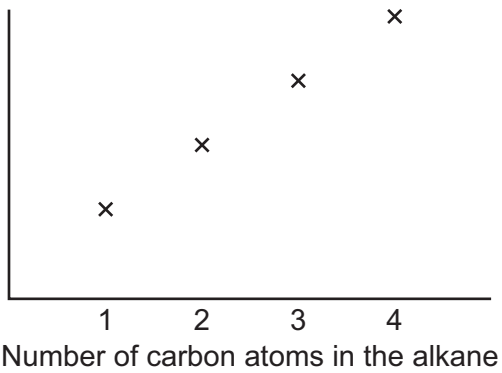
2 By cooling to –170 °C and then warming, it is possible to separate methane from petroleum gas.

3 By cooling to –100 °C, two liquid alkanes would be formed.

4 By cooling to –170 °C, all the alkanes would be solids.

8B The graph makes use of some of the data in the table.

The label on the vertical (*y*) axis has been omitted.



Which of the following could be the correct label for the *y*-axis?

1 either melting point or boiling point

2 either boiling point or the amount of oxygen required to burn the alkane

3 either boiling point or the amount of air required to burn the alkane

4 either the amount of oxygen or the amount of air required to burn the alkane

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8C The graph in part **B** shows points plotted. This is not the best way to represent this data.

Which type of graph or chart should be used?

1 a bar chart because the number of carbon atoms is a continuous variable

2 a bar chart because the number of carbon atoms is a discrete variable

3 a line graph because the number of carbon atoms is a continuous variable

4 a line graph because the number of carbon atoms is a discrete variable

8D The equation below shows the reaction when methane burns completely in oxygen.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

Which row in the table below shows how many molecules of carbon dioxide and molecules of water will be produced when a molecule of **propane** (C_3H_8) burns completely?

	Molecules of carbon dioxide	**Molecules of water**
1	2	4
2	3	4
3	4	8
4	3	6

Turn over for the next question

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QUESTION NINE

This question is about metals.

9A A scientist investigated some reactions of three metals, **K**, **L** and **M**.

- Metal **L** can be extracted by mixing its oxide with carbon and heating.
- Metal **M** cannot be extracted by mixing its oxide with carbon and heating.
- Hydrogen will displace metal **K** from its oxide but will not displace metal **L** from its oxide.
- The oxide of metal **K** is decomposed to the metal on heating alone.

The order of reactivity for the three metals, with the most reactive first, is . . .

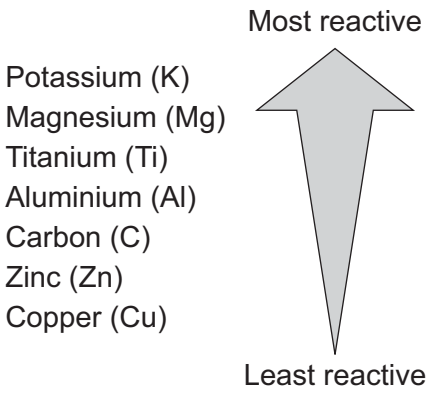
1 **K, L, M.**

2 **M, L, K.**

3 **L, K, M.**

4 **K, M, L.**

9B The order of reactivity for several metals and carbon is shown below.



Which of the following shows a correctly balanced equation for a possible reaction?

1 $ZnO + C \rightarrow Zn + CO_2$

2 $Cu + MgO \rightarrow CuO + Mg$

3 $2Mg + K_2O \rightarrow 2MgO + 2K$

4 $2Al + 3ZnO \rightarrow 3Zn + Al_2O_3$

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Titanium is extracted from titanium chloride by mixing the titanium chloride with sodium and heating the mixture. The reaction is carried out in a furnace above 500 °C.

It 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.

9C Which row in the table correctly describes the reaction for the 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

9D The extraction of iron in 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 the extraction of iron.

This is because . . .

1 the batch process is completed more quickly.

2 iron is less reactive than titanium.

3 the furnace is not maintained at a high temperature.

4 titanium chloride is not as pure as iron oxide.

END OF TEST

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There are no questions printed on this page

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Version 1:0: 26/07/10

ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A (4461)

Specification A

CHY1AP, CH1ASF & CH1ASH

Mark Scheme

2010 Examination – June Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

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GCSE
SCIENCE A (4461) / CHEMISTRY (4421)
Objective Test Answer Key
CHY1AP (Products from Rocks)
June 2010
Foundation Tier

Question	Key		
One	**A**	It is where thermal decomposition takes place.	**3**
	B	It is where only natural substances are mixed.	**2**
	C	It is where a natural substance is mixed with a man-made substance.	**4**
	D	It is where limestone is obtained.	**1**
Two	**A**	Alloy **A**	**1**
	B	Alloy **B**	**3**
	C	Alloy **C**	**4**
	D	Alloy **D**	**2**
Three	**A**	bonds	**4**
	B	electrons	**3**
	C	elements	**2**
	D	nuclei	**1**
Four	**A**	LPG	**1**
	B	Diesel	**4**
	C	Ethanol	**3**
	D	Hydrogen	**2**
Five	**A**	nitrogen dioxide	**4**
	B	carbon monoxide	**3**
	C	carbon dioxide	**2**
	D	soot (carbon)	**1**

	A	**B**	**C**	**D**
Six	**2**	**3**	**1**	**1**
Seven	**1**	**2**	**3**	**4**
Eight	**2**	**1**	**1**	**2**
Nine	**3**	**4**	**3**	**1**

GCSE
SCIENCE A (4461) / CHEMISTRY (4421)
Objective Test Answer Key
CHY1AP (Products from Rocks)
June 2010
Higher Tier

Question	*Key*		
One	**A**	nitrogen dioxide	**4**
	B	carbon monoxide	**3**
	C	carbon dioxide	**2**
	D	soot (carbon)	**1**
Two	**A**	Substance **A**	**3**
	B	Substance **B**	**2**
	C	Substance **C**	**4**
	D	Substance **D**	**1**

	A	**B**	**C**	**D**
Three	**2**	**1**	**1**	**2**
Four	**3**	**4**	**3**	**1**
Five	**3**	**1**	**1**	**2**
Six	**3**	**4**	**2**	**4**
Seven	**2**	**3**	**3**	**1**
Eight	**2**	**4**	**2**	**2**
Nine	**2**	**4**	**4**	**3**

AQA

Unit : CHY1AP **CHEMISTRY UNIT 1A**

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 6M10

28-JUN-10

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	nitrogen dioxide	○	○	○	○
1B	carbon monoxide	○	○	○	○
1C	carbon dioxide	○	○	○	○
1D	soot (carbon)	○	○	○	○

QUESTION TWO		1	2	3	4
2A	Substance A	○	○	○	○
2B	Substance B	○	○	○	○
2C	Substance C	○	○	○	○
2D	Substance D	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	Thermal decomposition takes place.	○	○	○	○
1B	Only natural substances are mixed.	○	○	○	○
1C	A natural substance is mixed with a man-made substance.	○	○	○	○
1D	Limestone is obtained.	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	Alloy A	○	○	○	○
2B	Alloy B	○	○	○	○
2C	Alloy C	○	○	○	○
2D	Alloy D	○	○	○	○

QUESTION THREE

		1	2	3	4
3A	bonds	○	○	○	○
3B	electrons	○	○	○	○
3C	elements	○	○	○	○
3D	nuclei	○	○	○	○

QUESTION FOUR

		1	2	3	4
4A	LPG	○	○	○	○
4B	Diesel	○	○	○	○
4C	Ethanol	○	○	○	○
4D	Hydrogen	○	○	○	○

QUESTION FIVE

		1	2	3	4
5A	nitrogen dioxide	○	○	○	○
5B	carbon monoxide	○	○	○	○
5C	carbon dioxide	○	○	○	○
5D	soot (carbon)	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
March 2010

Science A
Unit Chemistry C1a (Products from Rocks)

Chemistry
Unit Chemistry C1a (Products from Rocks)

CHY1AP

F&H

Wednesday 3 March 2010 Morning Session

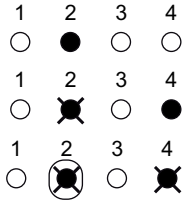
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.

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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 **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

New substances are formed when fuels are burned. Some of these substances affect the environment.

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

A carbon dioxide

B particles

C sulfur dioxide

D water vapour

	Environmental effect
1	acid rain
2	global dimming
3	global warming
4	non-polluting

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QUESTION TWO

This question is about metals.

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

A iron

B aluminium

C gold

D stainless steel

1	It is found in the Earth as the metal itself.
2	It is an alloy which is resistant to corrosion.
3	It is extracted by reduction of its oxide in a blast furnace.
4	It is extracted from its oxide by electrolysis.

QUESTION THREE

This question is about the substances involved in the thermal decomposition of calcium carbonate, $CaCO_3$

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

A atoms

B compounds

C non-metal elements

D elements

Calcium carbonate contains three . . . **1** . . . .

The formula for calcium carbonate contains a total of five . . . **2** . . . .

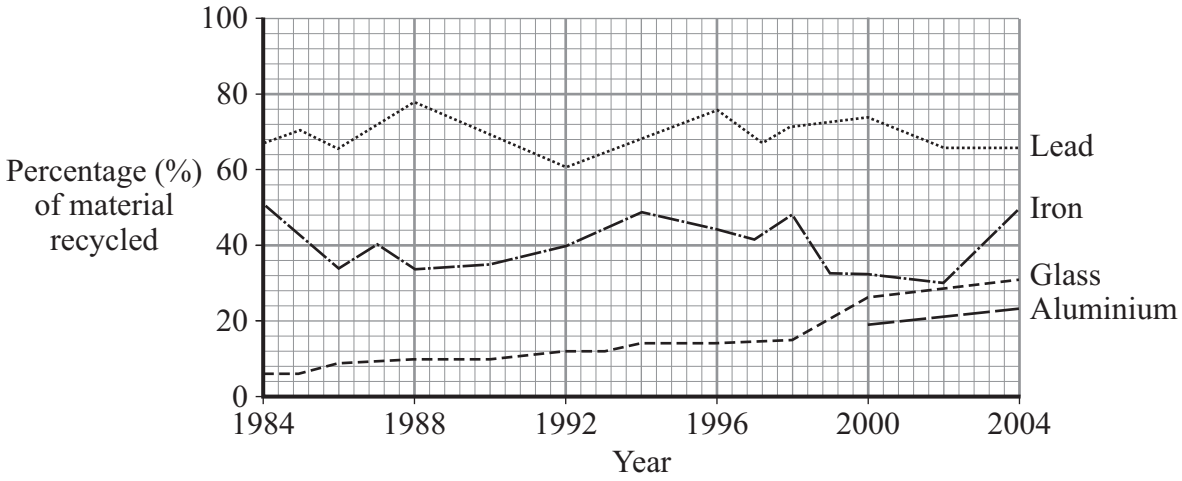
Calcium carbonate contains two . . . **3** . . . .

On heating, calcium carbonate decomposes into two new . . . **4** . . . .

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QUESTION FOUR

The graph shows the percentages of aluminium, glass, iron and lead that have been recycled in the UK between 1984 and 2004.



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

A aluminium

B glass

C iron

D lead

The material that has the highest percentage recycled is . . . **1** . . . .

Before 2000, there is no data for . . . **2** . . . .

Since 1984, there has been an increase in the percentage of . . . **3** . . . recycled.

Since 2002, there has been a steep increase in the percentage of . . . **4** . . . recycled.

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QUESTION FIVE

Anaesthetics are used to put patients to sleep before an operation.

Many new anaesthetics are based on alkanes in which some of the hydrogen atoms are replaced by fluorine (F), chlorine (Cl) and bromine (Br).

The temperature in an operating theatre is usually above 30 °C.

	Formula of the anaesthetic	Boiling point in °C	Additional information
A	$CF_3CHClBr$	50	Unstable in light
B	$CHF_2OCHClCF_3$	49	Very few side-effects
C	$(CF_3)_2CHOCH_2F$	59	High cost
D	$CF_3CHFOCHF_2$	24	Large amount needed to put patients to sleep

Match anaesthetics, **A**, **B**, **C** and **D**, with the numbers **1–4** below.

1 It does **not** require warming in the operating theatre to turn it into a gas.

2 It has to be stored in a dark bottle.

3 It contains the most fluorine atoms in its formula.

4 It would cause least harm to patients.

Turn over for the next question

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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

A company extracts limestone from a quarry. The company uses explosives to make thousands of tonnes of limestone fall to the floor of the quarry. The limestone is then removed by large lorries and taken to a factory for processing.

6A People live close to the quarry.

They find this unpleasant because . . .

1 they do not use limestone.

2 it is sometimes very noisy.

3 the quarry provides jobs.

4 there would be more places for parking.

6B The company wants to start limestone quarrying at weekends.

Some local people welcome this decision because . . .

1 the company will make more profit.

2 less limestone will be produced.

3 it will provide more jobs.

4 new technologies will be used.

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6C The company wants to find the opinions of local people.

The company would use . . .

1 a calculation.

2 an evaluation.

3 an experiment.

4 a survey.

6D The company stated that it's limestone is 'the best in the world'.

A second company says that this is **not** true. The reason for saying this is that . . .

1 the second company may sell less limestone.

2 all limestones are pure calcium carbonate.

3 all limestones have the same properties.

4 the second company produces the best limestone.

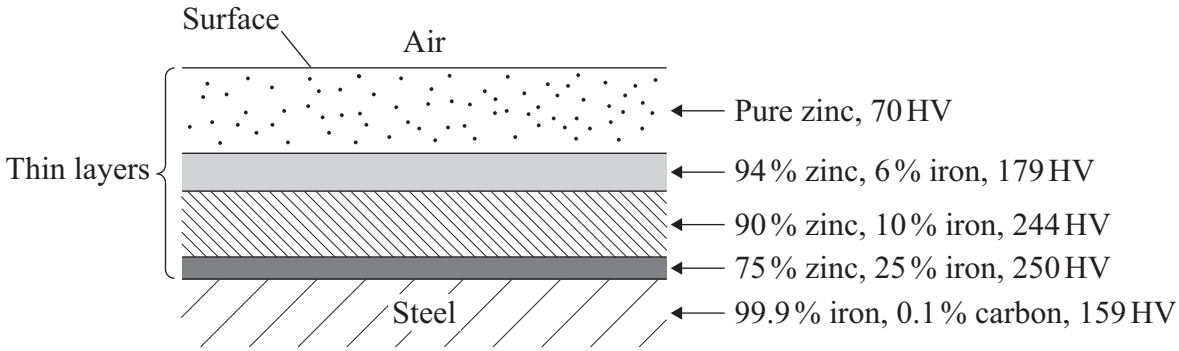
Turn over for the next question

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QUESTION SEVEN

Steel is dipped into molten zinc to prevent it from rusting. The zinc combines with the iron in the steel to form layers of zinc-iron alloys.

The diagram shows a cross-section through the layers.



HV is a unit of hardness. The higher the HV number, the harder the metal.

7A The diagram shows that . . .

1 the alloy layers are all of equal thickness.

2 all the layers are pure substances.

3 the steel is in contact with the air.

4 steel is harder than pure zinc.

7B The diagram shows that . . .

1 the amount of iron increases nearer the surface.

2 the percentage of zinc increases nearer the steel.

3 there is no pattern.

4 the percentage of zinc decreases nearer the steel.

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7C The diagram also shows that . . .

1 zinc is the hardest metal.

2 the zinc alloys are softer than steel.

3 increasing the iron content of the zinc alloys softens them.

4 for the zinc alloys, hardness increases with decreasing zinc content.

7D Steel car bodies are coated with zinc before painting.

This is to make them . . .

1 easier to recycle.

2 last longer.

3 weigh less.

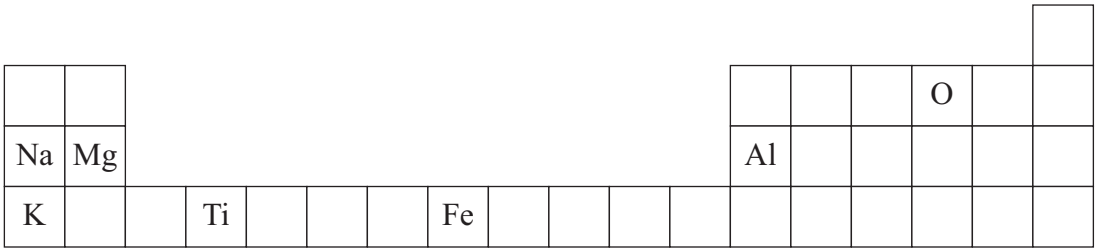
4 more dense.

Turn over for the next question

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QUESTION EIGHT

This is part of the periodic table.



8A What do the metals Fe (iron) and Ti (titanium) have in common?

1 They belong to the same group in the periodic table.

2 They are transition metals.

3 They do **not** conduct electricity.

4 They are resistant to corrosion.

8B When Fe (iron) and O (oxygen) react, iron atoms join with oxygen atoms to form iron oxide, Fe_2O_3

When this happens, . . .

1 the nuclei from iron and oxygen atoms join together.

2 electrons are lost and new atoms form.

3 electrons are transferred and chemical bonds hold the atoms together.

4 the nuclei are transferred and new atoms form.

8C Fe (iron) and O (oxygen) are in the periodic table but Fe_2O_3 (iron oxide) is not.

This is because iron oxide is . . .

1 an alloy.

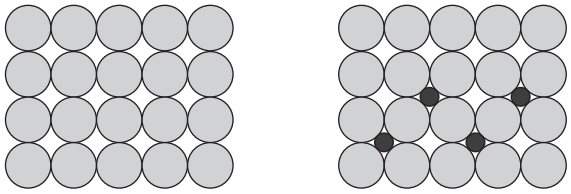
2 a compound.

3 an ore.

4 a gas.

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8D The diagram shows the arrangement of atoms in pure iron and in steel.



Pure iron **Steel**

Which row in the table shows the metal that is harder **and** correctly explains why it is harder?

	Harder metal	**Explanation**
1	Pure iron	It contains only one type of atom.
2	Steel	The atoms cannot easily slide over each other.
3	Pure iron	The atoms cannot easily slide over each other.
4	Steel	It contains only one type of atom.

Turn over for the next question

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QUESTION NINE

The alkanes are a series of hydrocarbons.

9A What is the general formula for the alkane series?

1 C_nH_n

2 C_nH_{2n}

3 C_nH_{2n+2}

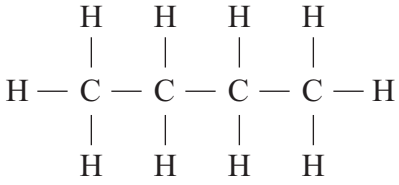
4 $C_{2n}H_{2n-2}$

The table shows information about four alkanes.

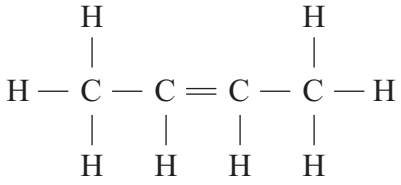
Alkane	Number of carbon atoms in each molecule
Methane	1
Butane	4
Octane	8
Dodecane	12

9B The structural formula for butane is . . .

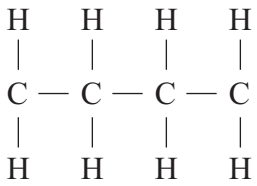
1



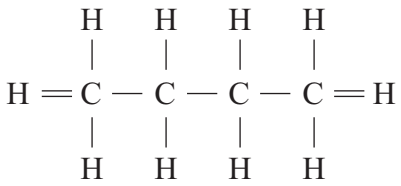
2



3



4



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9C When compared with octane, dodecane . . .

1 has a lower boiling point.

2 is easier to ignite.

3 evaporates less easily.

4 is less viscous.

9D When pure methane burns in plenty of oxygen, the only products are . . .

1 carbon dioxide and hydrogen.

2 carbon, carbon dioxide and water.

3 carbon dioxide, sulfur dioxide and water.

4 carbon dioxide and water.

END OF TEST

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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

Anaesthetics are used to put patients to sleep before an operation.

Many new anaesthetics are based on alkanes in which some of the hydrogen atoms are replaced by fluorine (F), chlorine (Cl) and bromine (Br).

The temperature in an operating theatre is usually above 30 °C.

	Formula of the anaesthetic	Boiling point in °C	Additional information
A	$CF_3CHClBr$	50	Unstable in light
B	$CHF_2OCHClCF_3$	49	Very few side-effects
C	$(CF_3)_2CHOCH_2F$	59	High cost
D	$CF_3CHFOCHF_2$	24	Large amount needed to put patients to sleep

Match anaesthetics, **A**, **B**, **C** and **D**, with the numbers **1–4** below.

1 It does **not** require warming in the operating theatre to turn it into a gas.

2 It has to be stored in a dark bottle.

3 It contains the most fluorine atoms in its formula.

4 It would cause least harm to patients.

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QUESTION TWO

This question is about types of reactions.

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

A reduction

B combustion

C thermal decomposition

D corrosion

	Example of the type of reaction
1	Copper carbonate forms copper oxide and carbon dioxide when heated.
2	Hydrogen reacts with oxygen to produce water.
3	Carbon steels react when exposed to air and water.
4	Zinc is obtained from zinc oxide by removal of the oxygen.

Turn over for the next question

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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

This is part of the periodic table.

															O		
Na	Mg											Al					
K			Ti				Fe										

3A What do the metals Fe (iron) and Ti (titanium) have in common?

1 They belong to the same group in the periodic table.

2 They are transition metals.

3 They do **not** conduct electricity.

4 They are resistant to corrosion.

3B When Fe (iron) and O (oxygen) react, iron atoms join with oxygen atoms to form iron oxide, Fe_2O_3

When this happens, . . .

1 the nuclei from iron and oxygen atoms join together.

2 electrons are lost and new atoms form.

3 electrons are transferred and chemical bonds hold the atoms together.

4 the nuclei are transferred and new atoms form.

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3C Fe (iron) and O (oxygen) are in the periodic table but Fe_2O_3 (iron oxide) is not.

This is because iron oxide is . . .

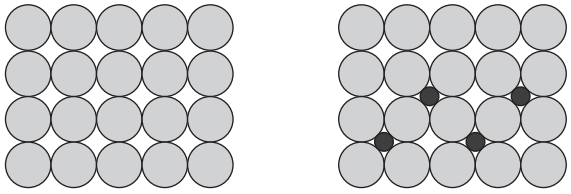
1 an alloy.

2 a compound.

3 an ore.

4 a gas.

3D The diagram shows the arrangement of atoms in pure iron and in steel.



Pure iron **Steel**

Which row in the table shows the metal that is harder **and** correctly explains why it is harder?

	Harder metal	**Explanation**
1	Pure iron	It contains only one type of atom.
2	Steel	The atoms cannot easily slide over each other.
3	Pure iron	The atoms cannot easily slide over each other.
4	Steel	It contains only one type of atom.

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QUESTION FOUR

The alkanes are a series of hydrocarbons.

4A What is the general formula for the alkane series?

1 C_nH_n

2 C_nH_{2n}

3 C_nH_{2n+2}

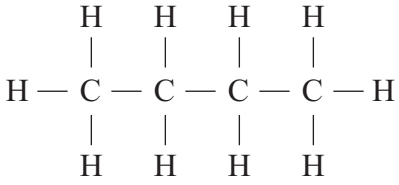
4 $C_{2n}H_{2n-2}$

The table shows information about four alkanes.

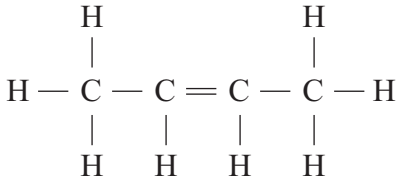
Alkane	Number of carbon atoms in each molecule
Methane	1
Butane	4
Octane	8
Dodecane	12

4B The structural formula for butane is . . .

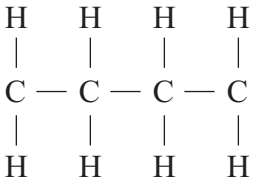
1



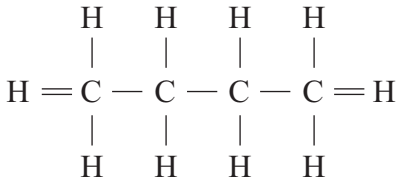
2



3



4



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4C When compared with octane, dodecane . . .

1 has a lower boiling point.

2 is easier to ignite.

3 evaporates less easily.

4 is less viscous.

4D When pure methane burns in plenty of oxygen, the only products are . . .

1 carbon dioxide and hydrogen.

2 carbon, carbon dioxide and water.

3 carbon dioxide, sulfur dioxide and water.

4 carbon dioxide and water.

Turn over for the next question

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QUESTION FIVE

Fuel oil is a mixture of compounds, mainly hydrocarbons.

Fuel oil is obtained from crude oil by fractional distillation.

5A Which of the following hydrocarbons is an alkane?

1 CH_6

2 C_3H_6

3 C_2H_6

4 C_2H_4

5B Which of the following describes how fuel oil is obtained from crude oil during fractional distillation?

1 boiling followed by evaporation

2 evaporation followed by boiling

3 evaporation followed by condensation

4 condensation followed by evaporation

5C Which of the following is a correct list of gases that might be produced by burning fuel oil?

1 carbon dioxide, water vapour, sulfur dioxide, carbon monoxide

2 hydrogen, carbon dioxide, sulfur dioxide, carbon monoxide

3 sulfur dioxide, carbon dioxide, water vapour, hydrogen

4 carbon, water vapour, sulfur dioxide, carbon monoxide

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5D Which row in the table correctly describes the type of combustion **and** a substance produced when fuel oil is burned?

	Type of combustion	**Substance produced**
1	Incomplete	Hydrogen
2	Complete	Carbon particles
3	Incomplete	Carbon particles
4	Complete	Carbon monoxide

Turn over for the next question

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QUESTION SIX

Titanium cannot be extracted by carbon reduction of its ore, which contains titanium dioxide, TiO_2

Titanium is obtained from titanium dioxide in two stages.

In **Stage 1**, the titanium dioxide is converted to titanium chloride ($TiCl_4$).

titanium dioxide + chlorine + carbon → titanium chloride + carbon dioxide

The possible escape of carbon dioxide and chlorine (a poisonous gas) can cause damage to the environment.

In **Stage 2**, the titanium chloride formed is reacted with sodium.

titanium chloride + sodium → titanium + sodium chloride

The sodium chloride formed is removed by washing the titanium with hydrochloric acid but the disposal of the acidic sodium chloride solution causes another environmental problem.

6A Which of the following is a correctly balanced equation for **Stage 2**?

1 $TiCl_4 + Na \rightarrow 4Ti + NaCl$

2 $TiCl_4 + Na \rightarrow Ti + 4NaCl$

3 $TiCl_4 + 4Na \rightarrow 4Ti + 4NaCl$

4 $TiC1_4 + 4Na \rightarrow Ti + 4NaCl$

6B Sodium, not carbon, is used to extract titanium from its compounds.

Which row in the table does this information suggest to be the order of reactivity for carbon, sodium and titanium?

	Most reactive ⟶		**Least reactive**
1	Sodium	Titanium	Carbon
2	Sodium	Carbon	Titanium
3	Titanium	Sodium	Carbon
4	Carbon	Titanium	Sodium

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6C In **Stage 1**, the gases carbon dioxide and chlorine should **not** be allowed to escape into the air because . . .

1 both add to global dimming.

2 both are poisonous gases.

3 carbon dioxide adds to global warming and chlorine is toxic.

4 carbon dioxide adds to global dimming and chlorine is expensive.

6D In **Stage 2**, the best way to dispose of the acidic sodium chloride solution is . . .

1 to pump it into the ocean.

2 to pump it into landfill sites.

3 to boil the solution until all the acid has evaporated.

4 to separate the acid from the salt so that both can be used in other chemical processes.

Turn over for the next question

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QUESTION SEVEN

Glass is made by heating limestone with silicon dioxide at 1700 °C. Sodium carbonate and potassium carbonate are also added.

7A Limestone contains calcium carbonate. The reaction between calcium carbonate and silicon dioxide produces calcium silicate. The equation for this reaction is:

$$CaCO_3 + SiO_2 \rightarrow \mathbf{X} + CO_2$$

X represents the formula for calcium silicate.

The equation will be balanced if the formula for calcium silicate is . . .

1 $CaSiO_2$

2 $CaSi_2O$

3 $CaSiO_3$

4 Ca_2SiO_2

Glass sheets are produced by pouring hot liquid glass onto molten tin. The glass floats on top of the molten tin and is allowed to cool. The viscosity of the hot liquid glass needs to be just right when poured onto the molten tin.

The viscosity of hot liquid glass depends partly on its temperature. The viscosity also depends on the composition of the glass.

The table shows how the lowest pouring temperature depends on the amounts of sodium and potassium in the glass.

Sodium percentage (%)	Potassium percentage (%)	Lowest pouring temperature in °C
0	20	450
4	16	400
10	10	390
16	4	395
18	2	410
20	0	440

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7B The manufacturer wants to use the lowest pouring temperature for the glass.

In what range of sodium content should further work be done to determine the lowest pouring temperature?

1 0% to 10%

2 4% to 16%

3 10% to 18%

4 16% to 20%

7C Listed below are four possible reasons why the manufacturer wants to use the lowest pouring temperature.

Reason **K** – It uses less energy
Reason **L** – It reduces the loss of glass by evaporation
Reason **M** – It makes the process cheaper
Reason **N** – It increases carbon emissions

Which of these are the most likely reasons for using the lowest pouring temperature?

1 Reasons **K** and **L**

2 Reasons **K** and **M**

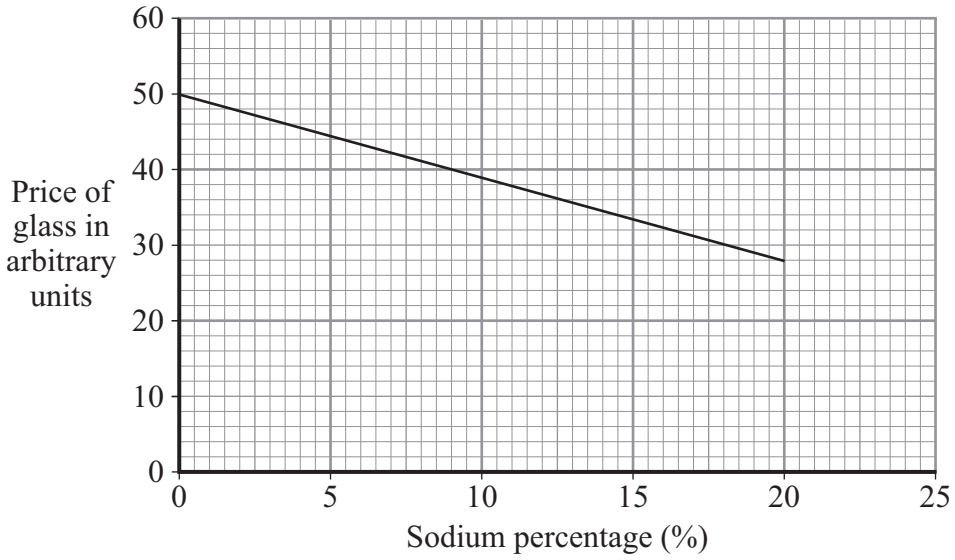
3 Reasons **L** and **N**

4 Reasons **M** and **N**

Question 7 continues on the next page

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7D The graph shows how the price of glass depends on the sodium percentage (%).



Use the information from the table on page 24 and the graph above.

What will be the effects of increasing the sodium percentage in the glass from 10% to 20%?

1 to decrease the price of the glass and decrease the pouring temperature

2 to decrease the price of the glass and increase the pouring temperature

3 to increase the price of the glass and decrease the pouring temperature

4 to increase the price of the glass and increase the pouring temperature

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Turn over for the next question

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QUESTION EIGHT

The table below gives the temperatures at which some metal carbonates decompose.

Name of metal carbonate	Position of metal in periodic table	Temperature at which it decomposes
Sodium carbonate	Group 1	Decomposes only above its melting point of 851 °C
Calcium carbonate	Third in Group 2	825 °C
Magnesium carbonate	Second in Group 2	350 °C
Zinc carbonate	In the transition metal block	300 °C

8A Which of the following pairs of carbonates would decompose at 750 °C?

1 sodium carbonate and calcium carbonate

2 calcium carbonate and magnesium carbonate

3 sodium carbonate and zinc carbonate

4 magnesium carbonate and zinc carbonate

8B A valid conclusion that can be drawn from the temperatures in the table is that . . .

1 transition metal carbonates are the most thermally stable.

2 Group 2 metal carbonates become less thermally stable down the group.

3 zinc carbonate is the least thermally stable.

4 Group 1 metal carbonates melt before they decompose.

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8C Extracting metal carbonates, such as limestone, from the ground can cause environmental damage.

A mining company issued this statement:

> Our research shows that our method of mining for limestone causes very little environmental damage.

This statement is . . .

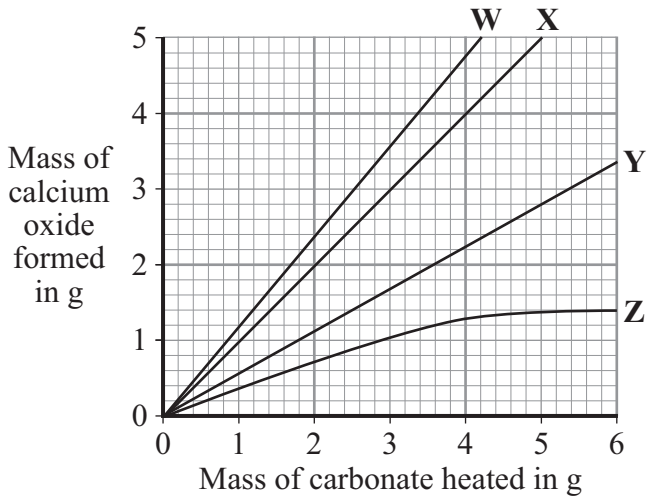
1 given on invalid evidence.

2 an invalid hypothesis.

3 a biased conclusion.

4 based on hearsay.

8D Assuming complete reaction, which of the following lines on the graph represents the mass of calcium oxide formed by heating different masses of calcium carbonate?



1 **W**

2 **X**

3 **Y**

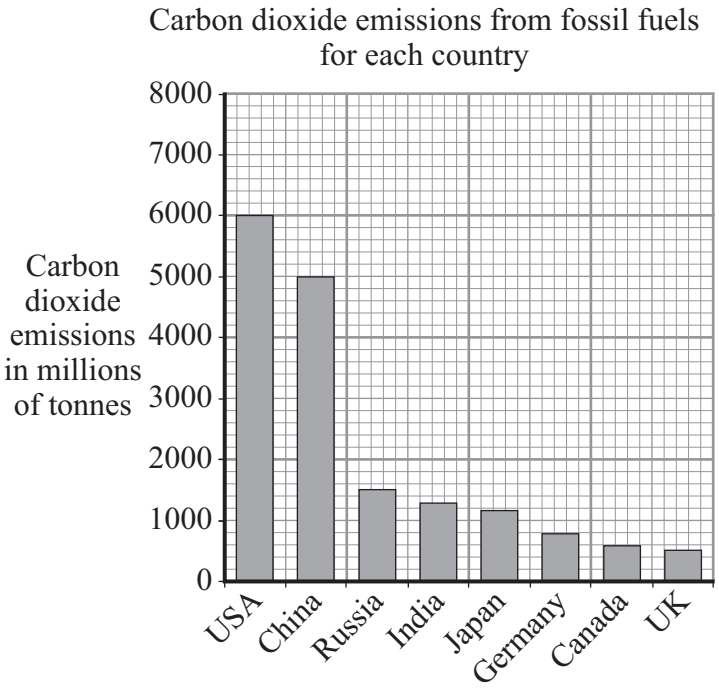
4 **Z**

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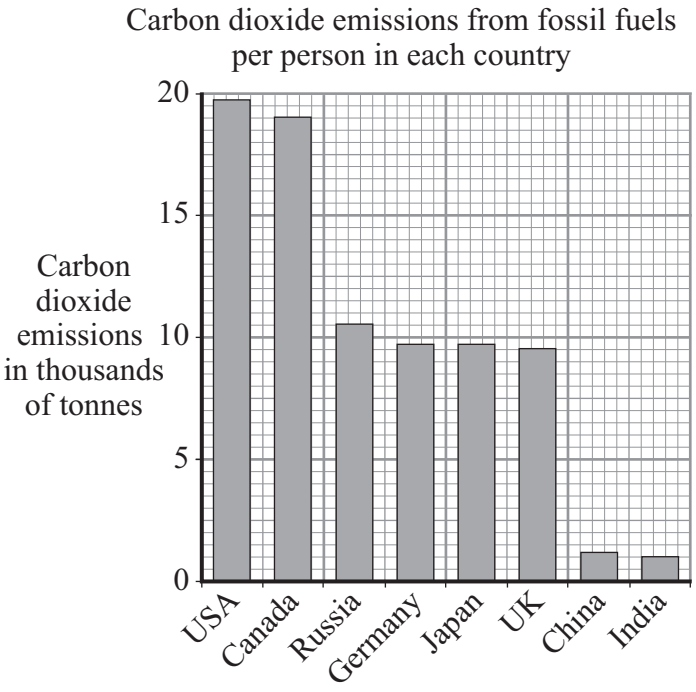
QUESTION NINE

The bar charts show the carbon dioxide emissions from burning fossil fuels only, for several countries, during 2004.
Bar chart **X** shows the carbon dioxide emissions for each country.
Bar chart **Y** shows the carbon dioxide emissions per person in each country.

Bar chart **X**



Bar chart **Y**



9A In the two bar charts, the countries are ranked in a different order.

Which statement explains the difference?

1 The units for carbon dioxide emissions are different and so the bar charts cannot be compared.

2 India's population is less than Japan's.

3 China and the USA have similar populations.

4 China has a very large population but very few people drive vehicles.

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9B There has been rapid economic expansion in China and India. New industry is being developed in these countries and this increases the use of fossil fuels.

Which of the following statements is correct if the economic expansion continues and the population in each country stays the same?

1 The bar for China will be higher in chart **X**, but will be lower in chart **Y**.

2 The bars for China and India will be lower in both charts **X** and **Y**.

3 The bars for China and India will be higher in both charts **X** and **Y**.

4 The bar for India will be higher in chart **X**, but will be lower in chart **Y**.

9C The data in the bar charts could be displayed in a different way.

Which one of the following gives a suitable display method with an appropriate explanation?

1 A straight line graph could be used because the dependent variable is continuous.

2 A pie chart could be used because the independent variable is categoric.

3 A smooth curve graph could be used because the independent variable is continuous.

4 A scattergraph could be used because there is a gradual change in carbon dioxide emissions.

9D Which one of the following would reduce the height of the bars in both bar charts?

1 compulsory use of catalytic converters that convert carbon monoxide to carbon dioxide

2 changing the vertical axis on bar chart **X** to measure in thousands of tonnes

3 planting more trees, which will absorb carbon dioxide

4 using more efficient engines that burn less fossil fuel per mile

END OF TEST

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Version 1:0: 09/04/10

ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A (4461)

Specification A

CHY1AP, CH1ASF & CH1ASH

Mark Scheme

2010 Examination – March Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

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GCSE
SCIENCE A (4461)/CHEMISTRY (4421)
Objective Test Answer Key
CHY1AP (Products from Rocks)
March 2010
Foundation Tier

Question	*Key*		
One	**A**	carbon dioxide	**3**
	B	particles	**2**
	C	sulfur dioxide	**1**
	D	water vapour	**4**
Two	**A**	iron	**3**
	B	aluminium	**4**
	C	gold	**1**
	D	stainless steel	**2**
Three	**A**	atoms	**2**
	B	compounds	**4**
	C	non-metal elements	**3**
	D	elements	**1**
Four	**A**	aluminium	**2**
	B	glass	**3**
	C	iron	**4**
	D	lead	**1**
Five	**A**	Anaesthetic **A**	**2**
	B	Anaesthetic **B**	**4**
	C	Anaesthetic **C**	**3**
	D	Anaesthetic **D**	**1**

	A	**B**	**C**	**D**
Six	**2**	**3**	**4**	**1**
Seven	**4**	**4**	**4**	**2**
Eight	**2**	**3**	**2**	**2**
Nine	**3**	**1**	**3**	**4**

GCSE
SCIENCE A (4461)/CHEMISTRY (4421)
Objective Test Answer Key
CHY1AP (Products from Rocks)
March 2010
Higher Tier

Question	*Key*		
One	**A**	Anaesthetic **A**	**2**
	B	Anaesthetic **B**	**4**
	C	Anaesthetic **C**	**3**
	D	Anaesthetic **D**	**1**
Two	**A**	reduction	**4**
	B	combustion	**2**
	C	thermal decomposition	**1**
	D	corrosion	**3**

	A	**B**	**C**	**D**
Three	**2**	**3**	**2**	**2**
Four	**3**	**1**	**3**	**4**
Five	**3**	**3**	**1**	**3**
Six	**4**	**1**	**3**	**4**
Seven	**3**	**2**	**2**	**2**
Eight	**4**	**3**	**3**	**3**
Nine	**4**	**3**	**2**	**4**

AQA

Unit : CHY1AP CHEMISTRY UNIT 1A

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 3G10

03-MAR-10

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	Anaesthetic A	○	○	○	○
1B	Anaesthetic B	○	○	○	○
1C	Anaesthetic C	○	○	○	○
1D	Anaesthetic D	○	○	○	○

QUESTION TWO		1	2	3	4
2A	reduction	○	○	○	○
2B	combustion	○	○	○	○
2C	thermal decomposition	○	○	○	○
2D	corrosion	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A carbon dioxide	○	○	○	○
1B particles	○	○	○	○
1C sulfur dioxide	○	○	○	○
1D water vapour	○	○	○	○

QUESTION TWO	1	2	3	4
2A iron	○	○	○	○
2B aluminium	○	○	○	○
2C gold	○	○	○	○
2D stainless steel	○	○	○	○

QUESTION THREE	1	2	3	4
3A atoms	○	○	○	○
3B compounds	○	○	○	○
3C non-metal elements	○	○	○	○
3D elements	○	○	○	○

QUESTION FOUR	1	2	3	4
4A aluminium	○	○	○	○
4B glass	○	○	○	○
4C iron	○	○	○	○
4D lead	○	○	○	○

QUESTION FIVE	1	2	3	4
5A Anaesthetic A	○	○	○	○
5B Anaesthetic B	○	○	○	○
5C Anaesthetic C	○	○	○	○
5D Anaesthetic D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
November 2009

Science A
Unit Chemistry C1a (Products from Rocks)

Chemistry
Unit Chemistry C1a (Products from Rocks)

CHY1AP

F&H

Thursday 19 November 2009 Morning Session

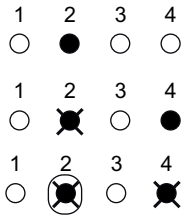
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.

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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 **FIVE**.

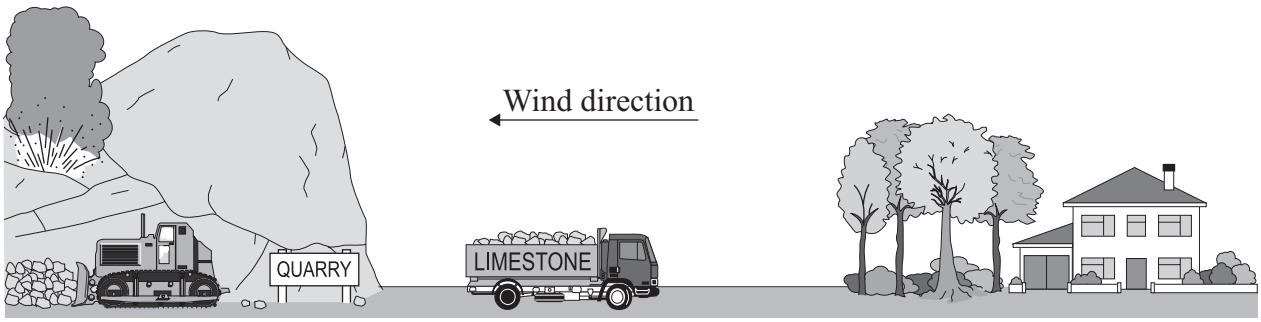
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The drawing shows a house near a limestone quarry.



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

A trees

B vehicle exhaust gases

C vehicle movements

D wind

Visual pollution for the people in the house is reduced by the . . . **1** . . . .

Noise pollution is caused by the . . . **2** . . . .

Dust is carried away from the house by the . . . **3** . . . .

Global warming might be increased by the . . . **4** . . . .

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QUESTION TWO

This question is about metals.

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

A metal ore

B reactive metal

C transition metal

D metal alloy

1	a substance that contains enough metal to make it worth extracting
2	a mixture of metals
3	a metal that is found in the central block of the periodic table
4	a metal that cannot be extracted by reduction using carbon

QUESTION THREE

The formula of hydrogen sulfide is H_2S.

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

A atoms

B electrons

C compounds

D elements

Hydrogen and sulfur are in the periodic table because they are . . . **1** . . . .

Hydrogen and sulfur are combined together in hydrogen sulfide, which is one of many known . . . **2** . . . .

The bonds in hydrogen sulfide are formed by shared pairs of . . . **3** . . . .

The formula of hydrogen sulfide contains a total of three . . . **4** . . . .

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QUESTION FOUR

Exhaust gases from petrol and diesel vehicles were measured under different driving conditions.

The table shows the results in parts per million (ppm).

	Driving conditions					
	Accelerating		**Steady speed**		**Slowing down**	
	Petrol	**Diesel**	**Petrol**	**Diesel**	**Petrol**	**Diesel**
Hydrocarbons in ppm	2000	200	1000	100	10 000	300
Carbon monoxide in ppm	25 000	1000	18 000	15	20 000	46
Nitrogen oxides in ppm	1020	856	650	240	20	30

Match the type of fuel and the driving conditions, **A**, **B**, **C** and **D**, with the exhaust gas descriptions **1–4** in the table below.

A diesel, steady speed

B diesel, slowing down

C petrol, accelerating

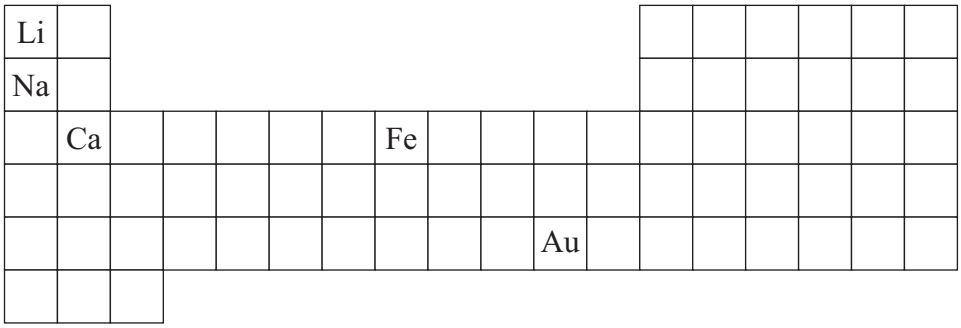
D petrol, slowing down

	Exhaust gas description
1	a total of 76 ppm of carbon monoxide and nitrogen oxides
2	the smallest amount of hydrocarbons
3	the highest total of carbon monoxide and nitrogen oxides
4	the most unburnt fuel

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QUESTION FIVE

The diagram shows part of the periodic table.



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

A Calcium (Ca)

B Lithium (Li)

C Gold (Au)

D Iron (Fe)

1	It will not react with oxygen or water even at high temperatures.
2	It forms the oxide known as quicklime.
3	It has properties most similar to those of sodium (Na).
4	It is a transition element found in the Earth as an oxide.

Turn over for the next question

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SECTION TWO

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

Each of these questions has four parts.

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

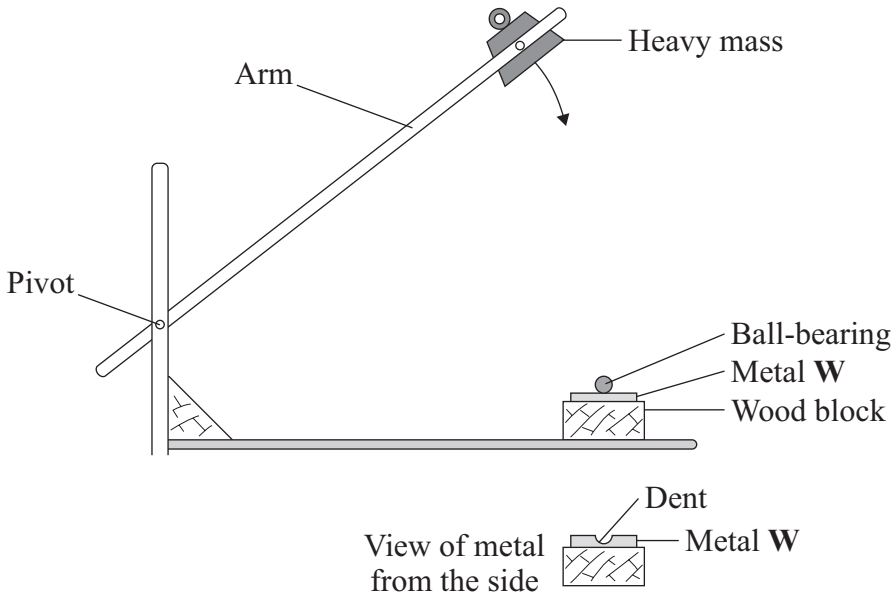
Mark your choices on the answer sheet.

QUESTION SIX

A student was asked to investigate the hardness of four metals, **W**, **X**, **Y** and **Z**. He used the apparatus shown in the diagram.

The student allowed the heavy mass to drop onto the ball-bearing resting on metal **W**. This made a dent in metal **W**. He measured the diameter of the dent.

The student repeated the experiment using metals **X**, **Y** and **Z**. He attempted to drop the heavy mass from the same height each time.



The results of the experiment are shown in the table.

Metal	Diameter of dent in mm
W	3.5
X	1.0
Y	2.5
Z	0.0

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6A The order of hardness of the metals, starting with the softest, is . . .

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

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

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

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

6B The student could make his results more precise by . . .

1 dropping a smaller mass onto the ball-bearing.

2 dropping the mass from different heights.

3 repeating the test on each metal and calculating the average diameter of the dent.

4 using an instrument with smaller divisions to measure the diameters of the dents.

6C Metal **W** is pure copper.

If a copper alloy was used instead, the diameter of the dent would be . . .

1 the same.

2 smaller.

3 larger.

4 deeper.

6D The student was asked to suggest some improvements to his experimental procedure.

Which of the following suggestions would be most likely to improve his results?

1 measure the time for the mass to fall from the point of release onto the ball-bearing

2 use a different ball-bearing for every test

3 use a screen around the apparatus to reduce the effects of draughts

4 use a ruler to make sure that the mass is always dropped from the same height

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QUESTION SEVEN

Test tubes used in school laboratories can be made from soda-lime glass or from boro-silicate glass.

Typical compositions of these two types of glass are shown in **Table 1**.

Table 1

	Percentage (%) composition					
	Silicon oxide	**Aluminium oxide**	**Calcium oxide**	**Magnesium oxide**	**Sodium oxide**	**Boron oxide**
Soda-lime glass	60–75	1	5–12	4	12–18	0
Boro-silicate glass	70–81	2–7	0.1	0	4–8	7–13

7A For boro-silicate glass, which of the following oxides shows the smallest range of percentage composition?

1 silicon oxide

2 aluminium oxide

3 sodium oxide

4 boron oxide

7B Boro-silicate glass has a higher melting point than soda-lime glass.

From the information given in **Table 1**, it is valid to conclude that this is because boro-silicate glass . . .

1 does **not** contain any magnesium oxide.

2 contains less silicon oxide.

3 has a different composition.

4 contains more oxides.

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Table 2 shows information about soda-lime and boro-silicate glass test tubes.

Table 2

	Cost of one test tube in pence	Density in g per cm^3	Average number of times it can be used	Melting point in °C
Soda-lime glass test tube	8	2.52	4	500
Boro-silicate glass test tube	18	2.23	12	1200

7C Schools use large numbers of test tubes.

The decision to buy soda-lime or boro-silicate glass test tubes for use in schools depends on . . .

1 the density and melting point.

2 the cost and how many times the test tube can be used.

3 the composition and density.

4 the melting point and quantities of impurities.

7D In an experiment, a student needs to heat a substance in a test tube to 700 °C.

She selects a boro-silicate glass test tube rather than a soda-lime glass test tube because the boro-silicate glass test tube . . .

1 contains less silicon oxide.

2 is more expensive.

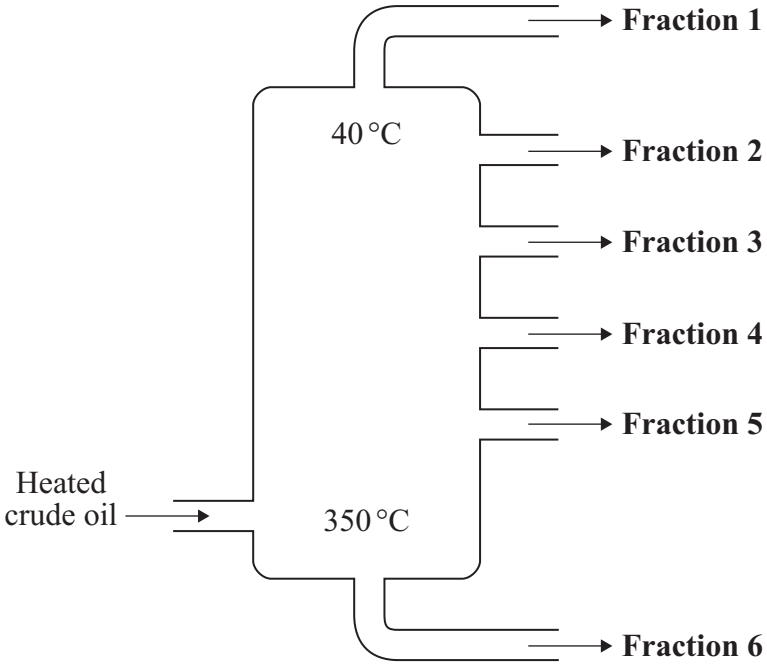
3 has a higher density.

4 has a melting point above 700 °C.

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QUESTION EIGHT

In a fractionating column, crude oil is separated into a number of fractions.



8A Each fraction contains . . .

1 only alkanes that are liquids.

2 only alkanes that condense at temperatures above 40 °C.

3 alkanes with similar boiling points.

4 alkanes with the same chemical formula.

8B Which statement is true for the alkanes in **Fraction 1**?

1 They burn to produce carbon dioxide and sulfur dioxide only.

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

3 They are saturated compounds.

4 They are compounds of carbon, hydrogen and oxygen.

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8C When compared with the alkanes in **Fraction 6**, the alkanes in **Fraction 1** . . .

1 will ignite more easily.

2 will be more viscous.

3 will have higher boiling points.

4 will have larger molecules.

8D In a molecule of the alkane called propane, there are eight hydrogen atoms.

The formula for propane is . . .

1 C_2H_8

2 C_3H_8

3 C_4H_8

4 C_3H_8O

Turn over for the next question

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QUESTION NINE

Duralumin is an alloy which contains copper and magnesium mixed with aluminium.

Aluminium is a low density metal but duralumin is used more often in making aeroplanes.

9A Aluminium, copper and magnesium are extracted from their naturally occurring compounds.

The method used for the extraction depends on . . .

1 the density of the metal.

2 the abundance of the metal compound in the Earth's crust.

3 the melting point of the metal compound.

4 the reactivity of the metal.

9B Copper can be extracted by strongly heating a mixture of the copper compound and carbon.

In this reaction, the copper compound is . . .

1 oxidised.

2 electrolysed.

3 reduced.

4 distilled.

9C Aluminium and magnesium are extracted by electrolysis.

One reason why this method is expensive is that . . .

1 the metals are resistant to corrosion.

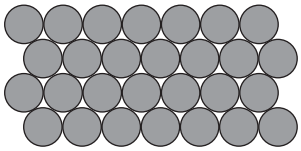
2 the process requires a large amount of energy.

3 the metals are less reactive than carbon.

4 the metal ores are very abundant.

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9D The diagram shows the arrangement of the atoms in pure aluminium.



Which row in the table correctly shows how the structure and properties are different in duralumin?

	Structure	Properties
1	The layers of atoms are distorted.	The alloy is harder.
2	The copper atoms attach strongly to the aluminium atoms.	The alloy is softer.
3	The layers of atoms are distorted.	The alloy is softer.
4	The magnesium atoms attach strongly to the aluminium atoms.	The alloy is harder.

END OF TEST

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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**.

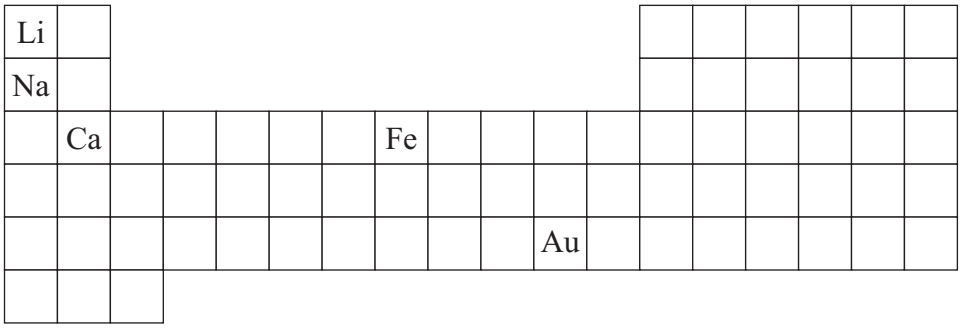
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows part of the periodic table.



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

A Calcium (Ca)

B Lithium (Li)

C Gold (Au)

D Iron (Fe)

1	It will not react with oxygen or water even at high temperatures.
2	It forms the oxide known as quicklime.
3	It has properties most similar to those of sodium (Na).
4	It is a transition element found in the Earth as an oxide.

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QUESTION TWO

This question is about four chemical substances involved in the two chemical reactions below.

$$ZnCO_3 \rightarrow ZnO + \text{Substance } \mathbf{X}$$

$$2ZnO + C \rightarrow 2Zn + \text{Substance } \mathbf{X}$$

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

A $ZnCO_3$

B C

C CO_2

D ZnO

1	It is the metal oxide produced by thermal decomposition.
2	It has a formula made up of five atoms of three different elements.
3	It is the compound produced in both reactions.
4	It will burn in a limited supply of air to produce carbon monoxide and carbon dioxide.

Turn over for the next question

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SECTION TWO

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

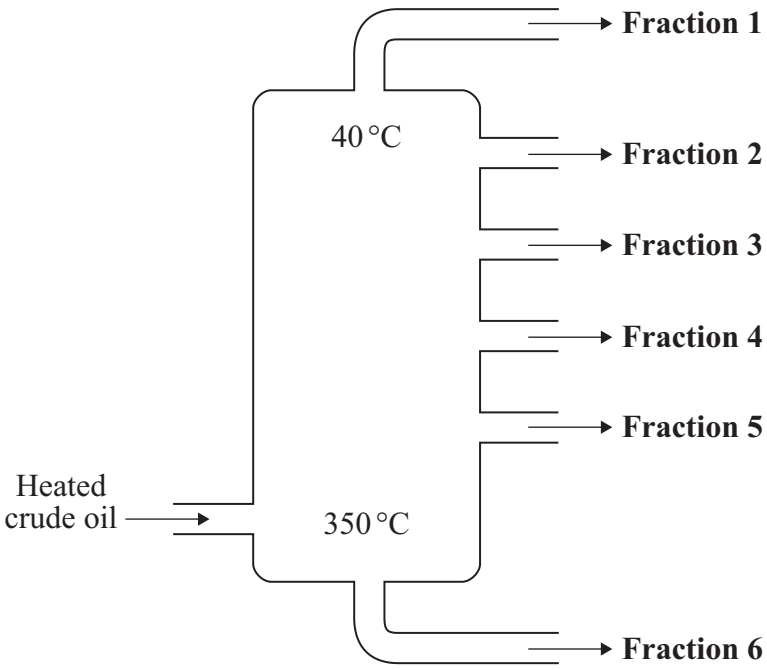
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION THREE

In a fractionating column, crude oil is separated into a number of fractions.



3A Each fraction contains . . .

1 only alkanes that are liquids.

2 only alkanes that condense at temperatures above 40 °C.

3 alkanes with similar boiling points.

4 alkanes with the same chemical formula.

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3B Which statement is true for the alkanes in **Fraction 1**?

1 They burn to produce carbon dioxide and sulfur dioxide only.

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

3 They are saturated compounds.

4 They are compounds of carbon, hydrogen and oxygen.

3C When compared with the alkanes in **Fraction 6**, the alkanes in **Fraction 1** . . .

1 will ignite more easily.

2 will be more viscous.

3 will have higher boiling points.

4 will have larger molecules.

3D In a molecule of the alkane called propane, there are eight hydrogen atoms.

The formula for propane is . . .

1 C_2H_8

2 C_3H_8

3 C_4H_8

4 C_3H_8O

Turn over for the next question

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QUESTION FOUR

Duralumin is an alloy which contains copper and magnesium mixed with aluminium.

Aluminium is a low density metal but duralumin is used more often in making aeroplanes.

4A Aluminium, copper and magnesium are extracted from their naturally occurring compounds.

The method used for the extraction depends on . . .

1 the density of the metal.

2 the abundance of the metal compound in the Earth's crust.

3 the melting point of the metal compound.

4 the reactivity of the metal.

4B Copper can be extracted by strongly heating a mixture of the copper compound and carbon.

In this reaction, the copper compound is . . .

1 oxidised.

2 electrolysed.

3 reduced.

4 distilled.

4C Aluminium and magnesium are extracted by electrolysis.

One reason why this method is expensive is that . . .

1 the metals are resistant to corrosion.

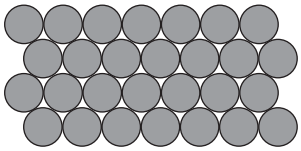
2 the process requires a large amount of energy.

3 the metals are less reactive than carbon.

4 the metal ores are very abundant.

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4D The diagram shows the arrangement of the atoms in pure aluminium.



Which row in the table correctly shows how the structure and properties are different in duralumin?

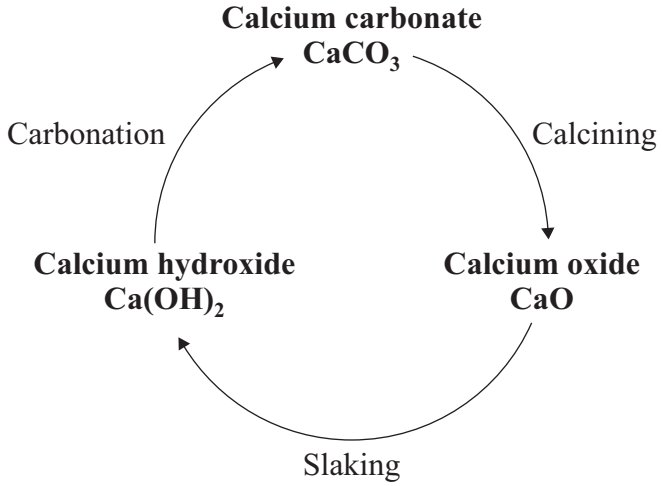
	Structure	Properties
1	The layers of atoms are distorted.	The alloy is harder.
2	The copper atoms attach strongly to the aluminium atoms.	The alloy is softer.
3	The layers of atoms are distorted.	The alloy is softer.
4	The magnesium atoms attach strongly to the aluminium atoms.	The alloy is harder.

Turn over for the next question

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QUESTION FIVE

The diagram shows substances and processes in the lime cycle.



The words calcining, slaking and carbonation are used in the lime industry to name the processes involved.

5A What type of reaction is described as *calcining* in the diagram?

1 neutralisation

2 thermal decomposition

3 combustion

4 hydration

5B What substance reacts with calcium oxide during *slaking*?

1 carbon dioxide

2 calcium hydroxide

3 hydrogen

4 water

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5C Which of the following is the correct equation for *carbonation*?

1 $Ca(OH)_2 \rightarrow CaCO_3 + H_2O$

2 $CaCO_3 \rightarrow CaO + CO_2$

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

4 $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

5D Which of the following parts of the lime cycle contributes to global warming?

1 calcining

2 slaking

3 carbonation

4 slaking and carbonation

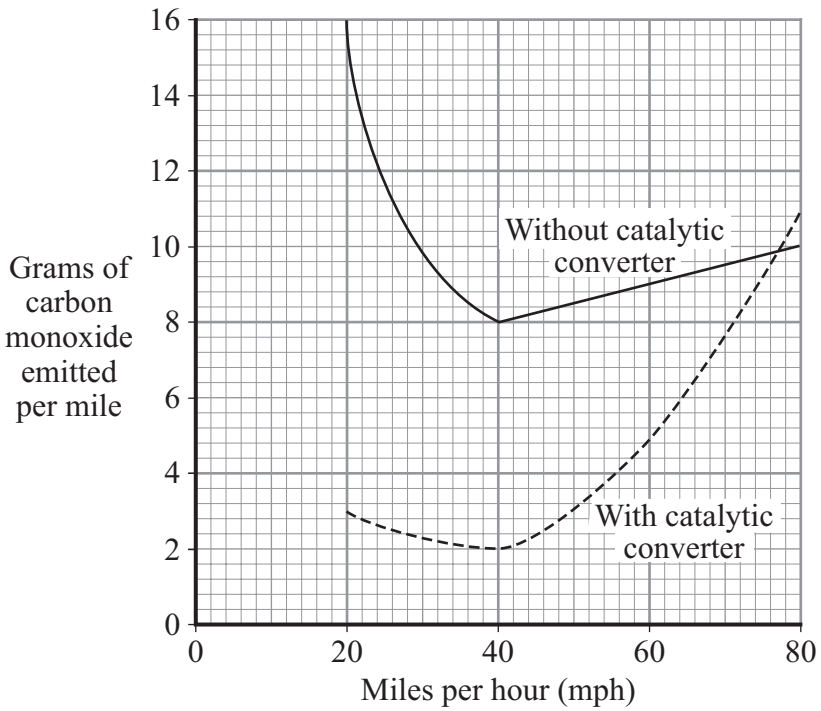
Turn over for the next question

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QUESTION SIX

Catalytic converters are fitted to car exhausts to reduce harmful emissions from the car.
In a catalytic converter, carbon monoxide is converted into carbon dioxide. However, catalytic converters are not 100 % efficient.

The graph shows the effect of a catalytic converter.



6A At 40 mph, a catalytic converter reduces carbon monoxide emissions by . . .

1 2 g per mile.

2 4 g per mile.

3 6 g per mile.

4 8 g per mile.

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6B At what speed does a car with a catalytic converter emit the same amount of carbon monoxide as a car without a catalytic converter?

1 40 mph

2 70 mph

3 77 mph

4 80 mph

6C Which statement about the graph is true?

1 Catalytic converters work best at speeds above 40 mph.

2 The higher the speed, the higher the carbon monoxide emissions.

3 There is no connection between speed and the amount of carbon monoxide emitted.

4 Catalytic converters are more effective at lower speeds.

6D All the carbon monoxide emitted into the atmosphere eventually forms carbon dioxide.

Which of the following statements is true?

1 Using catalytic converters reduces the amount of carbon dioxide put into the atmosphere by cars.

2 The effect that car emissions have on global warming is not changed by using catalytic converters.

3 Carbon dioxide levels are not affected by the use of cars.

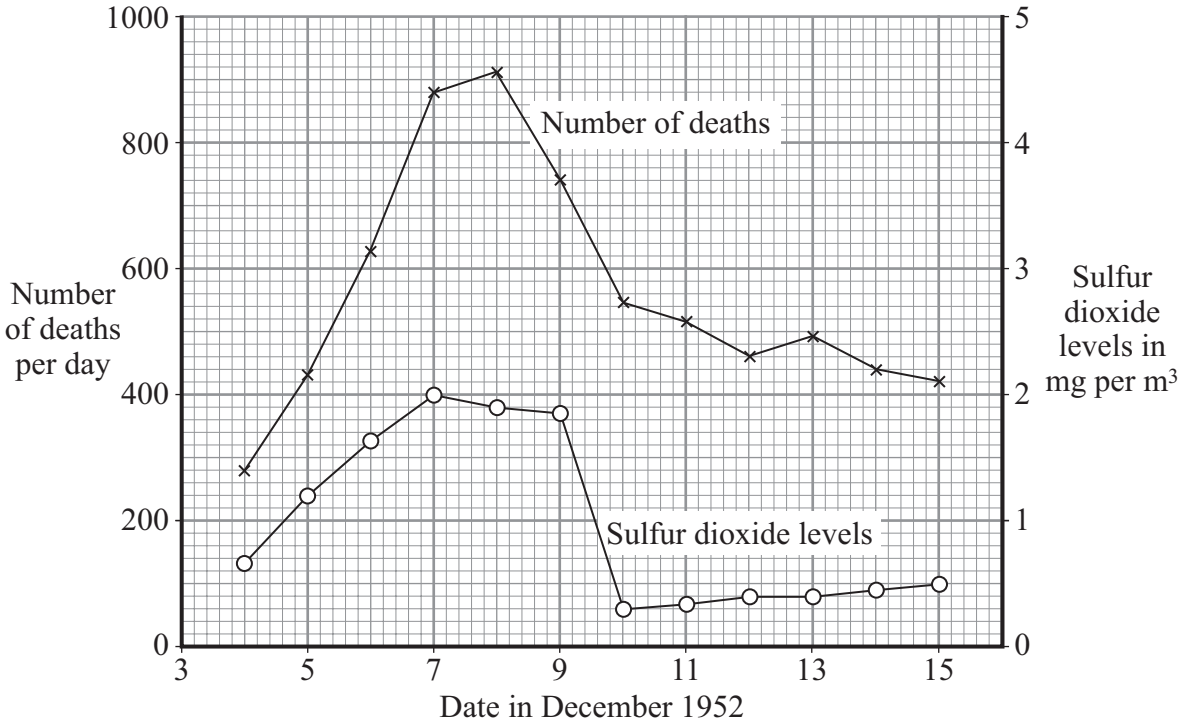
4 A car without a catalytic converter produces more carbon dioxide than a car fitted with one.

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QUESTION SEVEN

Smog is a mixture containing sulfur dioxide and smoke particles.

The graph below shows how the number of deaths due to sulfur dioxide varied during the Great Smog in London during December 1952.



7A It is generally agreed that sulfur dioxide caused the increase in the number of deaths in London in December 1952.

Which of the following would be the best argument **against** this conclusion?

1 The level of sulfur dioxide does **not** go as high as the number of deaths.

2 After a period of time, the sulfur dioxide levels increase but the number of deaths decreases.

3 The graphs show a similar pattern of increase and decrease.

4 The number of deaths increases faster than the sulfur dioxide levels increase.

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7B A group of students studying the Great Smog of London in 1952 wrote four statements after looking at the data.

Which one of their statements is correct?

1 The number of deaths peaks on the same day as sulfur dioxide levels peak.

2 The number of deaths always increases when sulfur dioxide levels increase.

3 On the day that sulfur dioxide levels reached 2 mg per m^3, there were 880 deaths.

4 If sulfur dioxide levels double, the number of deaths doubles.

7C Many cars now use low-sulfur fuels that were introduced in 2000. However, the amount of sulfur dioxide emissions from vehicles in the UK has increased since 2000.

This increase is because . . .

1 early versions of low-sulfur fuels did not burn correctly.

2 there is an increasing number of vehicles on UK roads.

3 there is now 5% ethanol (C_2H_5OH) in petrol.

4 sulfur dioxide is producing acid rain.

7D Sulfur dioxide can be removed from the waste gases from power stations using a process called flue gas desulfurisation. This is done by reacting the sulfur dioxide [SO_2] with calcium carbonate [$CaCO_3$], calcium oxide [CaO], calcium hydroxide [$Ca(OH)_2$] or magnesium oxide [MgO].

Which one of the following is **not** a correctly balanced equation for a reaction taking place during *flue gas desulfurisation*?

1 $SO_2 + MgO \rightarrow MgSO_3$

2 $SO_2 + CaO \rightarrow CaSO_3$

3 $SO_2 + CaCO_3 \rightarrow CaSO_3 + CO_2$

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

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QUESTION EIGHT

The equations show three reactions of the metal magnesium.

$$3Mg + Fe_2O_3 \rightarrow 3MgO + 2Fe$$

$$Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$$

$$2Mg + O_2 \rightarrow 2MgO$$

8A Magnesium **cannot** be produced by heating magnesium oxide with carbon.

Which row in the table correctly shows the order of reactivity for iron, magnesium and carbon?

	Most reactive ⟶		**Least reactive**
1	magnesium	carbon	iron
2	magnesium	iron	carbon
3	iron	carbon	magnesium
4	carbon	iron	magnesium

8B When magnesium reacts with hydrochloric acid, hydrogen is given off.
When excess magnesium is used and all the acid has reacted, hydrogen continues to be given off from the remaining magnesium.

The probable reason is that . . .

1 magnesium reacts with water to form hydrogen and magnesium hydroxide.

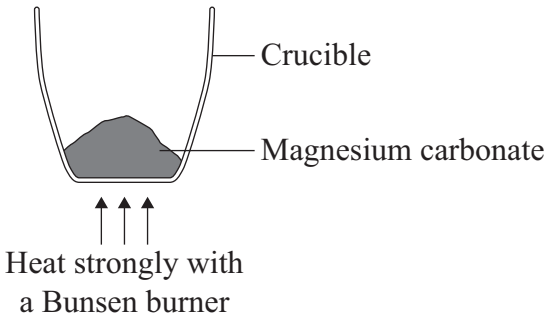
2 magnesium reacts with water to form hydrogen and oxygen.

3 magnesium reacts with oxygen from the air to form hydrogen and magnesium oxide.

4 magnesium oxide decomposes to form magnesium, oxygen and hydrogen.

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A student heated some magnesium carbonate in an open crucible.



The table shows the mass of the crucible and its contents at two-minute intervals.

Time in minutes	0	2	4	6	8
Mass of crucible and contents in grams	20.80	20.55	20.25	19.85	19.85

8C Which solid substances will the crucible contain after heating for two minutes?

1 magnesium carbonate only

2 magnesium oxide only

3 magnesium carbonate and magnesium oxide

4 magnesium and magnesium oxide

8D The student found that when the experiment was repeated using sodium carbonate instead of magnesium carbonate, there was no loss in mass.

The best conclusion that the student could make is that sodium carbonate . . .

1 does **not** decompose when heated.

2 only decomposes when heated gently.

3 only decomposes when heated to a very high temperature.

4 does **not** decompose at Bunsen burner temperatures.

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QUESTION NINE

Hydrogen is used as a fuel. Some of its properties are listed below.

K – There is a plentiful supply in water and natural gas.
L – On combustion, it forms water only.
M – It requires a lot of energy to make.
N – It is highly flammable.
P – Because of its very low density, large volumes are needed.
Q – It is difficult to liquefy because its boiling point is –253 °C.

9A Which pair of properties shows that hydrogen is a useful fuel?

1 **K** and **M**

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

3 **N** and **P**

4 **M** and **Q**

9B Which pair of properties might hold back the use of hydrogen as a fuel?

1 **M** and **P**

2 **K** and **Q**

3 **L** and **P**

4 **N** and **K**

9C Which of the following events would delay the development of hydrogen as a fuel?

1 the discovery of large deposits of crude oil

2 global warming becoming much worse

3 the cost of hydrogen manufacture decreasing

4 a safe way of storing hydrogen being discovered

9D The very rare and expensive metal palladium is capable of storing many hundreds of times its own volume of hydrogen.

Which statement would be true if palladium was used in hydrogen-powered cars?

1 The increased demand for palladium will cause its price to fall.

2 Hydrogen that has been stored in palladium will have a lower density.

3 Hydrogen that has been stored in palladium is hard to burn.

4 The cars would be safer than those that store hydrogen in pressurised cylinders.

END OF TEST

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Version 1:0: 21/11/09

ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A (4461)

Specification A

CHY1AP, CH1ASF & CH1ASH

Mark Scheme

2009 Examination – November Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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GCSE
SCIENCE A (4461)/CHEMISTRY (4421)
Objective Test Answer Key
CHY1AP (Products from Rocks)
November 2009
Foundation Tier

Question	Key		
One	**A**	trees	**1**
	B	vehicle exhaust gases	**4**
	C	vehicle movements	**2**
	D	wind	**3**
Two	**A**	metal ore	**1**
	B	reactive metal	**4**
	C	transition metal	**3**
	D	metal alloy	**2**
Three	**A**	atoms	**4**
	B	electrons	**3**
	C	compounds	**2**
	D	elements	**1**
Four	**A**	diesel, steady speed	**2**
	B	diesel, slowing down	**1**
	C	petrol, accelerating	**3**
	D	petrol, slowing down	**4**
Five	**A**	Calcium (Ca)	**2**
	B	Lithium (Li)	**3**
	C	Gold (Au)	**1**
	D	Iron (Fe)	**4**

	A	B	C	D
Six	**2**	**4**	**2**	**4**
Seven	**3**	**3**	**2**	**4**
Eight	**3**	**3**	**1**	**2**
Nine	**4**	**3**	**2**	**1**

GCSE
SCIENCE A (4461)/CHEMISTRY (4421)
Objective Test Answer Key
CHY1AP (Products from Rocks)
November 2009
Higher Tier

Question	Key		
One	**A**	Calcium (Ca)	**2**
	B	Lithium (Li)	**3**
	C	Gold (Au)	**1**
	D	Iron (Fe)	**4**
Two	**A**	Formulae **A** ($ZnCO_3$)	**2**
	B	Formulae **B** (C)	**4**
	C	Formulae **C** (CO_2)	**3**
	D	Formulae **D** (ZnO)	**1**

	A	**B**	**C**	**D**
Three	**3**	**3**	**1**	**2**
Four	**4**	**3**	**2**	**1**
Five	**2**	**4**	**4**	**1**
Six	**3**	**3**	**4**	**2**
Seven	**2**	**3**	**2**	**4**
Eight	**1**	**1**	**3**	**4**
Nine	**2**	**1**	**1**	**4**

AQA

Unit : CHY1AP CHEMISTRY UNIT 1A

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : BG09

19-NOV-09

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	Calcium (Ca)	○	○	○	○
1B	Lithium (Li)	○	○	○	○
1C	Gold (Au)	○	○	○	○
1D	Iron (Fe)	○	○	○	○

QUESTION TWO		1	2	3	4
2A	Formula A	○	○	○	○
2B	Formula B	○	○	○	○
2C	Formula C	○	○	○	○
2D	Formula D	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A trees	○	○	○	○
1B vehicle exhaust gases	○	○	○	○
1C vehicle movements	○	○	○	○
1D wind	○	○	○	○

QUESTION TWO	1	2	3	4
2A metal ore	○	○	○	○
2B reactive metal	○	○	○	○
2C transition metal	○	○	○	○
2D metal alloy	○	○	○	○

QUESTION THREE	1	2	3	4
3A atoms	○	○	○	○
3B electrons	○	○	○	○
3C compounds	○	○	○	○
3D elements	○	○	○	○

QUESTION FOUR	1	2	3	4
4A diesel, steady speed	○	○	○	○
4B diesel, slowing down	○	○	○	○
4C petrol, accelerating	○	○	○	○
4D petrol, slowing down	○	○	○	○

QUESTION FIVE	1	2	3	4
5A Calcium (Ca)	○	○	○	○
5B Lithium (Li)	○	○	○	○
5C Gold (Au)	○	○	○	○
5D Iron (Fe)	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature							

General Certificate of Secondary Education
June 2009

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

CHEMISTRY
Unit Chemistry C1a (Products from Rocks)

Monday 22 June 2009 Morning Session

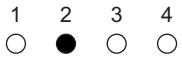
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

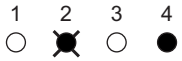
Time allowed: 30 minutes

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.

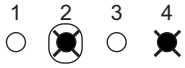
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 **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 limestone.

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

A calcium carbonate

B carbon dioxide

C calcium oxide

D calcium hydroxide

1	This is a gas made when limestone is heated strongly.
2	Limestone is mainly made up of this compound.
3	This is another name for slaked lime.
4	This is another name for quicklime.

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QUESTION TWO

This question is about four metal ores.

	Name of ore	Formula	
A	Haematite	Fe_2O_3	Fe = iron; O = oxygen
B	Silver ore	Ag	Ag = silver
C	Chalcopyrite	$CuFeS_2$	Cu = copper; Fe = iron; S = sulfur
D	Bauxite	Al_2O_3	Al = aluminium; O = oxygen

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

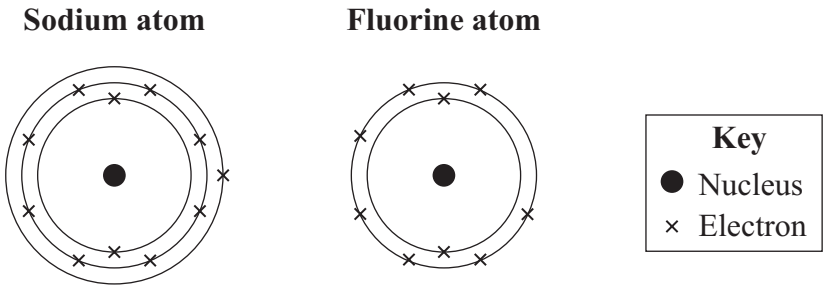
1	It contains two metals.
2	It is an oxide of iron.
3	It contains the uncombined metal.
4	It cannot be reduced by mixing with carbon then heating.

Turn over for the next question

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QUESTION THREE

The diagram shows a sodium atom and a fluorine atom.



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

A a compound

B an electron

C a bond

D an element

Fluorine is made of only one sort of atom. This means that it is . . . **1** . . . .

When sodium and fluorine react, the fluorine atom takes . . . **2** . . . from the sodium atom.

The atoms are then held together by . . . **3** . . . .

Sodium and fluorine combine together to form sodium fluoride, which is . . . **4** . . . .

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QUESTION FOUR

This question is about some aspects of gold mining.

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

A environmentally

B politically

C ethically

D economically

A fall in the price of gold affects a mining company . . . **1** . . . .

Dumping the poisonous cyanide compounds used to extract gold is wrong . . . **2** . . . .

Government permission for gold mining in a country is . . . **3** . . . essential before mining can start.

Employing workers in unsafe working conditions is wrong . . . **4** . . . .

QUESTION FIVE

This question is about substances that can be burned in air.

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

A C_2H_5SH

B C_2H_6

C C_2H_2

D C

1	It would contribute to the formation of acid rain when burned.
2	It is an alkane.
3	It corresponds to the general formula C_nH_{2n-2}
4	It forms only carbon dioxide when burned in air.

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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

Hybrid cars have both battery-powered motors and petrol engines. Hybrid cars have been developed so they have reduced carbon dioxide emissions when compared with petrol and diesel cars.

Some figures from manufacturers' tests are shown in the table.

Hybrid car	Price	Fuel economy in km per litre of petrol	Carbon dioxide emissions in g per km
K	£18 000	21.6	109
L	£20 000	23.1	104
M	£11 000	26.1	99
N	£16 000	27.1	94

6A The best way to obtain accurate figures for the amount of carbon dioxide emitted by the cars is to drive each car . . .

1 100 m.

2 1 km.

3 1 km five times, and take the highest value.

4 1 km five times, and take an average value.

6B For these cars, as the fuel economy in km per litre of petrol increases, . . .

1 the carbon dioxide emitted by the cars increases.

2 the carbon dioxide emitted by the cars decreases.

3 the cost of the cars increases.

4 the cars use more petrol per km.

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6C An independent motoring organisation tested the same cars. The values obtained for carbon dioxide emissions were a lot higher than those quoted by the manufacturers.

These values could be considered to be more reliable because the independent motoring organisation . . .

1 is **not** involved in selling cars.

2 is more concerned about environmental issues.

3 used equipment with a greater range.

4 is more likely to be biased.

6D One environmental advantage that a petrol hybrid car has over a conventional petrol car is that . . .

1 when the battery is working, no energy is being used.

2 the addition of a battery makes it lighter.

3 when only the battery is working, no carbon dioxide is being emitted.

4 the car will produce more sulfur dioxide.

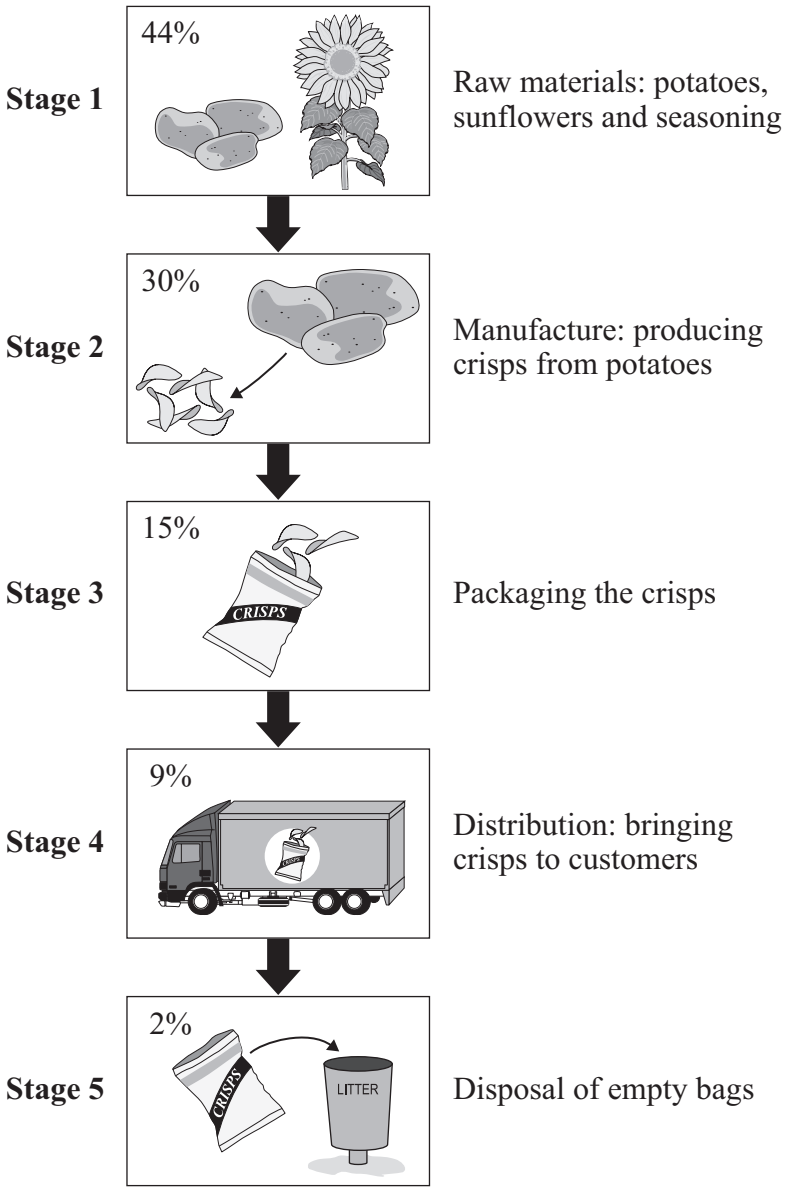
Turn over for the next question

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QUESTION SEVEN

The carbon footprint of a food product is the amount of carbon dioxide that is produced in its preparation, distribution and disposal.

The diagram shows the percentage (%) of the carbon footprint for each stage for a bag of crisps.



7A How is most of the carbon dioxide produced in **Stage 4**?

1 It is produced when the lorries use fuel.

2 It is breathed out by the driver.

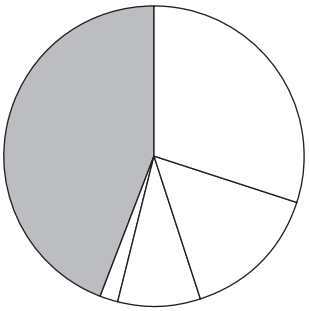
3 It escapes from the crisp bags.

4 It escapes from the tyres of the lorries.

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7B Which stage on the diagram corresponds to the shaded area on the pie chart?

Percentage (%) of carbon footprint for a bag of crisps



1 **Stage 1**

2 **Stage 2**

3 **Stage 3**

4 **Stage 4**

7C If the company reduces the carbon footprint for a bag of crisps, this will help to . . .

1 reduce the acid rain that it causes.

2 meet government targets on global warming.

3 reduce the sale of crisps which contribute to obesity.

4 reduce the use of sunflower oil.

7D Which of the following changes would reduce the carbon footprint for the bag of crisps?

1 increase the sales of the crisps

2 change the colour of the crisp bags

3 pack many more bags of crisps into each lorry

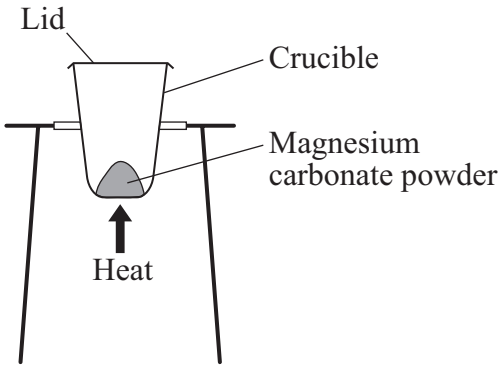
4 increase the size of the lorry fleet

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QUESTION EIGHT

A student carried out an investigation using these instructions:

- weigh a crucible and lid
- put the sample of magnesium carbonate powder into the crucible
- weigh the crucible, lid and powder
- heat the crucible strongly
- allow to cool and weigh again
- repeat the heating, cooling and weighing until constant mass is achieved.



The student observed that the mass of the crucible and its contents decreased.

8A The substance remaining in the crucible after strong heating is . . .

1 magnesium.

2 magnesium oxide.

3 magnesium hydroxide.

4 carbon dioxide.

8B What caused the change in mass?

1 Some of the crucible burned away.

2 Water was given off.

3 Carbon dioxide was given off.

4 Some of the magnesium carbonate evaporated.

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8C Why was the powder heated until constant mass was achieved?

1 to make sure that the magnesium carbonate had completely reacted

2 to make the test more reliable

3 to make sure that the balance was accurate

4 because the Bunsen burner was not hot enough

8D What type of reaction occurred in the crucible?

1 distillation

2 decomposition

3 combustion

4 evaporation

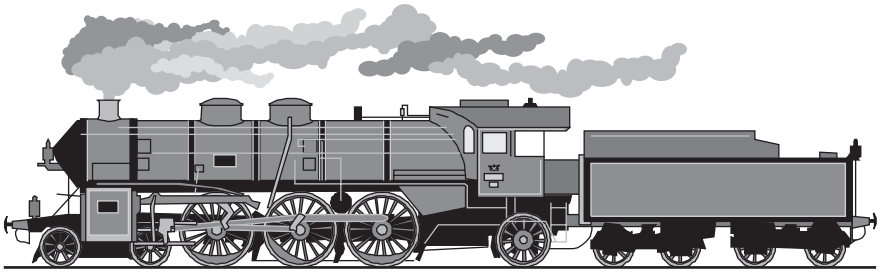
Turn over for the next question

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QUESTION NINE

Read the following newspaper extract.

Copper shortage puts the brakes on Flying Scotsman renovation



A major overhaul of the steam locomotive Flying Scotsman has been delayed by more than a year because of the lack of copper for the engine's firebox.

Copper is at a record high price because of huge demand from China's rapidly growing economy. The price had been falling over the previous 30 years, which had discouraged exploration for new supplies.

Other users have been forced to switch to cheaper materials, with plumbers using plastic rather than copper pipes, and telecoms firms using fibre-optic cables rather than copper wire.

9A The firebox of a steam locomotive is where coal is burned to boil water.

Which of these properties is **not** important when using copper in the firebox of a steam locomotive?

1 Copper is a good conductor of heat.

2 Copper has a high melting point.

3 Copper is a good conductor of electricity.

4 Copper is easily hammered and bent into shape.

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9B Which row in the table explains why copper was important to plumbers and telecoms firms?

	Plumbers	Telecoms firms
1	High melting point	Good heat conductor
2	Good electrical conductor	High melting point
3	Resistant to corrosion	Good electrical conductor
4	High boiling point	Good electrical conductor

9C Which of the following would make the copper shortage in China and other countries worse?

1 recycling scrap copper rather than burying it in landfill sites

2 developing alternative materials to do the same job as copper

3 extraction of copper from low-grade ores

4 forcing suppliers to reduce the price of copper

9D Why is it environmentally important to recycle copper rather than mine fresh copper ore?

1 Copper ores are non-renewable, and a lot of energy is needed to extract copper from its ore.

2 There are enormous reserves of copper ore which are not expected to run out for hundreds of years.

3 Copper ores are cheap, and scrap copper is easy to dispose of in landfill sites.

4 Copper recycling is difficult and uses more energy when compared with processing new ores.

END OF TEST

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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 substances that can be burned in air.

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

A C_2H_5SH

B C_2H_6

C C_2H_2

D C

1	It would contribute to the formation of acid rain when burned.
2	It is an alkane.
3	It corresponds to the general formula C_nH_{2n-2}
4	It forms only carbon dioxide when burned in air.

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QUESTION TWO

Methane gas (CH_4) burns in oxygen.

This is the chemical equation for the reaction:

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

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

A compounds

B bonds

C products

D elements

Methane and oxygen are the reactants but carbon dioxide and water are the . . . **1** . . . of the reaction.

The atoms in carbon dioxide and water are held together by . . . **2** . . . .

Methane, carbon dioxide and water are . . . **3** . . . .

The equation is balanced because in the reaction there is no change in the total number of atoms of each of the . . . **4** . . . .

Turn over for the next question

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SECTION TWO

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

Each of these questions has four parts.

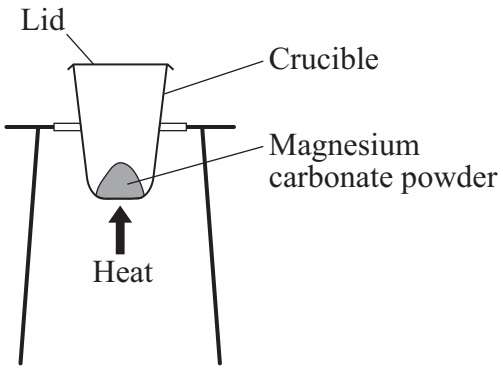
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

A student carried out an investigation using these instructions:

- weigh a crucible and lid
- put the sample of magnesium carbonate powder into the crucible
- weigh the crucible, lid and powder
- heat the crucible strongly
- allow to cool and weigh again
- repeat the heating, cooling and weighing until constant mass is achieved.



The student observed that the mass of the crucible and its contents decreased.

3A The substance remaining in the crucible after strong heating is . . .

1 magnesium.

2 magnesium oxide.

3 magnesium hydroxide.

4 carbon dioxide.

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3B What caused the change in mass?

1 Some of the crucible burned away.

2 Water was given off.

3 Carbon dioxide was given off.

4 Some of the magnesium carbonate evaporated.

3C Why was the powder heated until constant mass was achieved?

1 to make sure that the magnesium carbonate had completely reacted

2 to make the test more reliable

3 to make sure that the balance was accurate

4 because the Bunsen burner was not hot enough

3D What type of reaction occurred in the crucible?

1 distillation

2 decomposition

3 combustion

4 evaporation

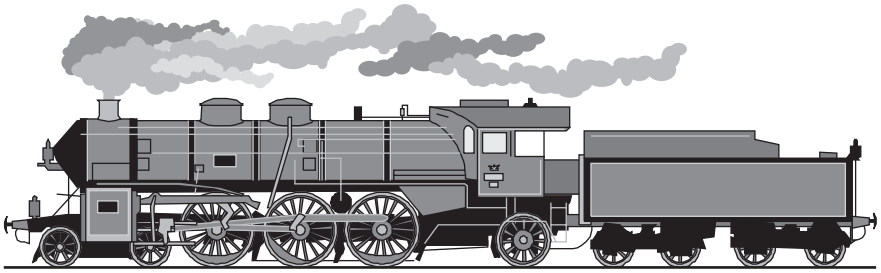
Turn over for the next question

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QUESTION FOUR

Read the following newspaper extract.

Copper shortage puts the brakes on Flying Scotsman renovation



A major overhaul of the steam locomotive Flying Scotsman has been delayed by more than a year because of the lack of copper for the engine's firebox.

Copper is at a record high price because of huge demand from China's rapidly growing economy. The price had been falling over the previous 30 years, which had discouraged exploration for new supplies.

Other users have been forced to switch to cheaper materials, with plumbers using plastic rather than copper pipes, and telecoms firms using fibre-optic cables rather than copper wire.

4A The firebox of a steam locomotive is where coal is burned to boil water.

Which of these properties is **not** important when using copper in the firebox of a steam locomotive?

1 Copper is a good conductor of heat.

2 Copper has a high melting point.

3 Copper is a good conductor of electricity.

4 Copper is easily hammered and bent into shape.

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4B Which row in the table explains why copper was important to plumbers and telecoms firms?

	Plumbers	Telecoms firms
1	High melting point	Good heat conductor
2	Good electrical conductor	High melting point
3	Resistant to corrosion	Good electrical conductor
4	High boiling point	Good electrical conductor

4C Which of the following would make the copper shortage in China and other countries worse?

1 recycling scrap copper rather than burying it in landfill sites

2 developing alternative materials to do the same job as copper

3 extraction of copper from low-grade ores

4 forcing suppliers to reduce the price of copper

4D Why is it environmentally important to recycle copper rather than mine fresh copper ore?

1 Copper ores are non-renewable, and a lot of energy is needed to extract copper from its ore.

2 There are enormous reserves of copper ore which are not expected to run out for hundreds of years.

3 Copper ores are cheap, and scrap copper is easy to dispose of in landfill sites.

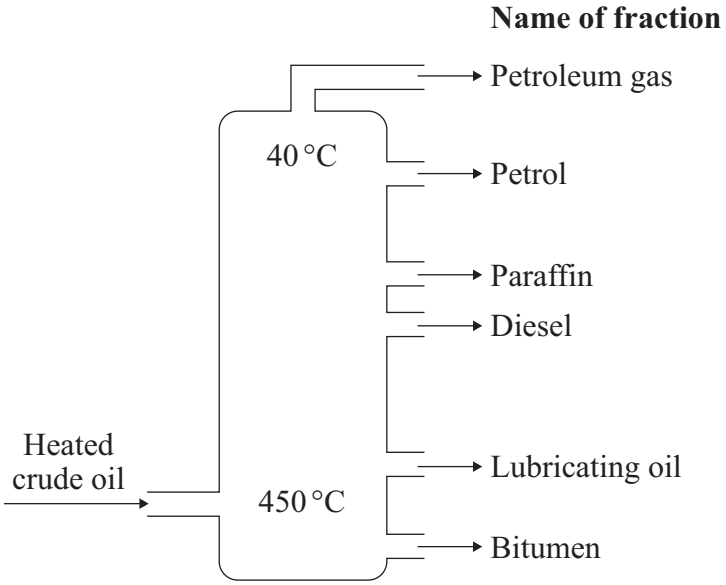
4 Copper recycling is difficult and uses more energy when compared with processing new ores.

Turn over for the next question

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QUESTION FIVE

In a fractionating column, crude oil is separated into a number of fractions.



5A The crude oil separates into fractions in the fractionating column because . . .

1 it changes from a liquid to a vapour.

2 crude oil vapour condenses at 100 °C.

3 crude oil vapour condenses at different temperatures.

4 decomposition of the crude oil occurs.

5B The diesel fraction boils over a range of temperatures from about 250 °C to 340 °C.

The fraction does **not** have a fixed boiling point because . . .

1 the temperature in the fractionating column is **not** constant.

2 the hydrocarbons in the fraction have different chemical properties.

3 the fraction contains a mixture of hydrocarbons.

4 liquid hydrocarbons boil at temperatures above 250 °C.

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5C The hydrocarbons from the bitumen fraction will . . .

1 be difficult to ignite at room temperature.

2 have small molecules.

3 be gases or liquids at room temperature.

4 have a small number of carbon atoms in each molecule.

5D A hydrocarbon from the lubricating oil fraction burns, in air, with a smoky flame.

This suggests that . . .

1 the hydrocarbon contains sulfur as an impurity.

2 there is only partial combustion of the hydrocarbon.

3 the hydrocarbon has small molecules.

4 when the hydrocarbon burns, it is oxidised.

Turn over for the next question

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QUESTION SIX

Two problems caused by the gases released when fossil fuels are burned are:

- acid rain, caused by sulfur dioxide and oxides of nitrogen
- global warming, caused by carbon dioxide.

Fuel manufacturers have introduced low-sulfur fuels to try to reduce the sulfur dioxide emissions.

6A Low-sulfur fuels were introduced in the UK in 2000. The amount of acid rain gases from transport increased from 2000 to 2004.

This increase could be due to . . .

1 the partial combustion of low-sulfur fuels.

2 an increasing number of vehicles on the UK's roads.

3 increasing emissions of carbon monoxide.

4 some sulfur dioxide not dissolving in rain water.

6B Carbon monoxide and oxides of nitrogen can be removed by a catalytic converter in the exhaust system of vehicles. The two gases, carbon monoxide (CO) and nitrogen dioxide (NO_2), react to produce carbon dioxide (CO_2) and nitrogen (N_2).

The balanced equation that correctly describes this reaction is . . .

1 $CO + NO_2 \rightarrow CO_2 + N_2$

2 $2CO + NO_2 \rightarrow 2CO_2 + N_2$

3 $3CO + 2NO_2 \rightarrow 3CO_2 + N_2$

4 $4CO + 2NO_2 \rightarrow 4CO_2 + N_2$

6C The conversion of carbon monoxide and nitrogen dioxide to carbon dioxide and nitrogen will . . .

1 decrease acid rain and decrease global warming.

2 decrease acid rain and increase global warming.

3 increase acid rain and increase global warming.

4 increase acid rain and decrease global warming.

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6D Environmentalists have encouraged the use of hydrogen as a fuel instead of petrol because . . .

1 hydrogen is a renewable fuel obtained from sugar.

2 carbon monoxide is the main product of combustion.

3 no carbon dioxide is produced when hydrogen is burned.

4 hydrogen produces only low levels of sulfur dioxide when burned.

Turn over for the next question

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QUESTION SEVEN

This question is about three metals, copper, lead and zinc.

7A Copper is found in the Earth's crust as the metal itself.

Lead and zinc are also found in the Earth's crust, but only as compounds such as oxides and sulfides.

These facts suggest that . . .

1 copper is a very reactive metal.

2 lead and zinc are transition metals, but copper is not.

3 lead and zinc react rapidly with oxygen and sulfur, but copper does not.

4 lead and zinc are more reactive than copper.

7B A naturally occurring compound of zinc is hydrozincite, $2ZnCO_3.3Zn(OH)_2$

Which row in the table correctly shows the number of elements, and the number of atoms of oxygen in the formula for hydrozincite?

	Number of elements	**Number of atoms of oxygen**
1	4	12
2	4	8
3	5	5
4	6	4

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7C Zinc is also found as zincite, ZnO.

The metal can be extracted from zincite by mixing it with carbon and heating strongly.

Which row in the table correctly shows the name for this process and the products?

	Name of process	Products
1	electrolysis	zinc and carbon dioxide
2	leaching	zinc and oxygen
3	reduction	zinc and oxygen
4	reduction	zinc and carbon dioxide

Lead and zinc compounds are often found together in the same ore.

The metals can be extracted by mixing the ore with carbon and heating strongly in a furnace. They can then be separated.

The table shows the melting points and boiling points of lead and zinc.

	Lead	Zinc
Melting point in °C	328	420
Boiling point in °C	1740	907

The furnace operates at a temperature of 1200 °C.

7D How will the lead and zinc be separated?

1 Molten lead remains in the furnace and the zinc evaporates.

2 Molten lead and molten zinc form two separate layers in the furnace.

3 Molten zinc remains in the furnace and the lead evaporates.

4 Zinc and lead vapours leave the furnace and are separated in a condenser.

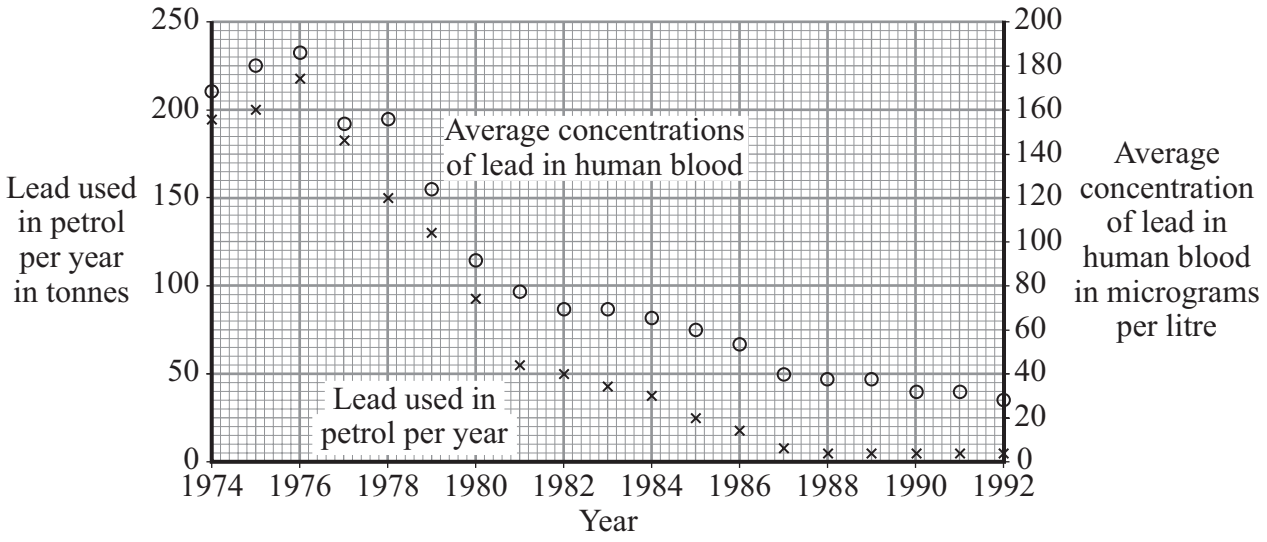
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QUESTION EIGHT

Lead compounds were added to petrol to improve its performance. The lead compounds leave the engine through the exhaust system.
During the 1970s, unleaded petrol was introduced, and between the 1970s and the 1990s leaded petrol was gradually removed from sale in petrol stations.

The information in the graph was collected from one area of North America between 1974 and 1992.
The graph shows:

- the amounts of lead used in petrol (×)
- the average concentrations of lead in human blood (○).



8A What conclusion can be drawn from the graph?

1 Lead concentration in human blood is always greater than the amount of lead used.

2 There is a positive correlation between lead concentration in human blood and the year.

3 There is a positive correlation between the amount of lead used and the concentration of lead in human blood.

4 Lead concentration in human blood and the amount of lead used per year were almost the same in 1977.

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8B The lead concentration in human blood will probably **not** drop to zero because . . .

1 some people will store leaded petrol.

2 lead will get into human blood from other sources.

3 scientists find it difficult to measure small quantities of lead.

4 lead concentrations rise when more unleaded petrol is burned during the summer months.

8C The points plotted on the graph for the average concentration of lead in human blood are always above the points plotted for the amount of lead used in petrol.

This is because . . .

1 micrograms per litre is a larger unit than tonnes.

2 people inhale fumes from petrol every day, so it accumulates.

3 the units are different and the scale for the *y*-axis for concentration in human blood creates a higher line.

4 the efficiency of the engine has been reduced, increasing the petrol consumption.

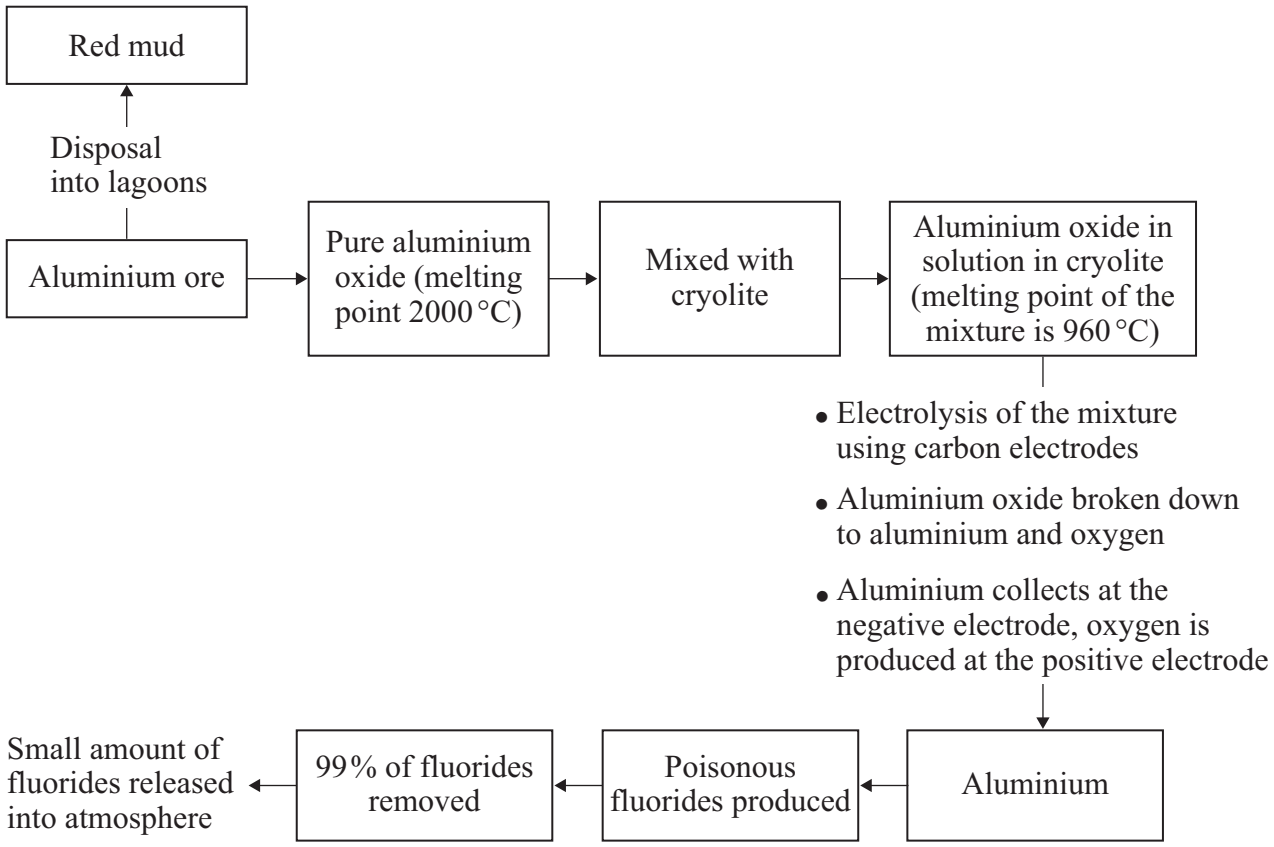
8D Which row in the table shows an advantage and a disadvantage of using unleaded petrol?

	Advantage	**Disadvantage**
1	Less lead released into the air	A replacement additive was needed and it cost a lot to develop
2	Cars will travel shorter distances	Lead will not be used as much
3	Lead levels in human blood will decrease	Companies will lose money removing lead from petrol
4	Less money will be spent on removing lead from petrol	Companies will need to store the lead removed from petrol

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QUESTION NINE

The flow chart shows the stages in the extraction of aluminium.



9A The red mud from the aluminium ore is disposed of by dumping in lagoons. The red mud contains iron oxide.

The most likely reason why iron is **not** extracted from the red mud is that . . .

1 the iron oxide evaporates too quickly.

2 there is no transportation system nearby.

3 it is **not** economic compared to other sources of iron.

4 iron oxide from the lagoons cannot be reduced by carbon.

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9B Why is pure aluminium oxide mixed with cryolite before electrolysis?

1 to produce an aluminium alloy

2 to reduce the breakdown of aluminium oxide

3 to lower the melting point so less energy is used during electrolysis

4 to react with impurities in the aluminium oxide

9C During electrolysis, the positive carbon electrode is rapidly used up causing emissions.

The main component of these emissions contributes to . . .

1 global dimming.

2 global warming.

3 acid rain.

4 red mud lagoons.

9D It is important to monitor the amount of poisonous fluorides released into the atmosphere.

Plants absorb these fluorides. The amounts of fluorides in plants can be found by chemical analysis.

The best information would be found by chemical analysis of plants that are growing . . .

1 in all the workers' homes.

2 at exactly one kilometre in all directions from the factory.

3 at various distances in all directions from the factory.

4 at various distances in an easterly direction from the factory.

END OF TEST

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Version 1:0: 21/07/09

ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A (4461)

Specification A

CHY1AP, CH1ASF & CH1ASH

Mark Scheme

2009 Examination – June Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

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GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

June 2009

Foundation Tier

Question	*Key*		
One	**A**	calcium carbonate	**2**
	B	carbon dioxide	**1**
	C	calcium oxide	**4**
	D	calcium hydroxide	**3**
Two	**A**	haematite	**2**
	B	silver ore	**3**
	C	chalcopyrite	**1**
	D	bauxite	**4**
Three	**A**	a compound	**4**
	B	an electron	**2**
	C	a bond	**3**
	D	an element	**1**
Four	**A**	environmentally	**2**
	B	politically	**3**
	C	ethically	**4**
	D	economically	**1**
Five	**A**	Substance **A**	**1**
	B	Substance **B**	**2**
	C	Substance **C**	**3**
	D	Substance **D**	**4**

	A	**B**	**C**	**D**
Six	**4**	**2**	**1**	**3**
Seven	**1**	**1**	**2**	**3**
Eight	**2**	**3**	**1**	**2**
Nine	**3**	**3**	**4**	**1**

GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

June 2009

Higher Tier

Question	*Key*		
One	**A**	Substance **A**	**1**
	B	Substance **B**	**2**
	C	Substance **C**	**3**
	D	Substance **D**	**4**
Two	**A**	compounds	**3**
	B	bonds	**2**
	C	products	**1**
	D	elements	**4**

	A	**B**	**C**	**D**
Three	**2**	**3**	**1**	**2**
Four	**3**	**3**	**4**	**1**
Five	**3**	**3**	**1**	**2**
Six	**2**	**4**	**2**	**3**
Seven	**4**	**1**	**4**	**1**
Eight	**3**	**2**	**3**	**1**
Nine	**3**	**3**	**2**	**3**

AQA

Unit : CHY1AP CHEMISTRY UNIT 1A

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 6M09

22-JUN-09

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	substance A	○	○	○	○
1B	substance B	○	○	○	○
1C	substance C	○	○	○	○
1D	substance D	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	compounds	○	○	○	○
2B	bonds	○	○	○	○
2C	products	○	○	○	○
2D	elements	○	○	○	○

QUESTION THREE

	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR

	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE

	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	calcium carbonate	○	○	○	○
1B	carbon dioxide	○	○	○	○
1C	calcium oxide	○	○	○	○
1D	calcium hydroxide	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	Haematite	○	○	○	○
2B	Silver ore	○	○	○	○
2C	Chalcopyrite	○	○	○	○
2D	Bauxite	○	○	○	○

QUESTION THREE

		1	2	3	4
3A	a compound	○	○	○	○
3B	an electron	○	○	○	○
3C	a bond	○	○	○	○
3D	an element	○	○	○	○

QUESTION FOUR

		1	2	3	4
4A	environmentally	○	○	○	○
4B	politically	○	○	○	○
4C	ethically	○	○	○	○
4D	economically	○	○	○	○

QUESTION FIVE

		1	2	3	4
5A	substance A	○	○	○	○
5B	substance B	○	○	○	○
5C	substance C	○	○	○	○
5D	substance D	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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2212

Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
March 2009

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

CHEMISTRY
Unit Chemistry C1a (Products from Rocks)

Wednesday 4 March 2009 Morning Session

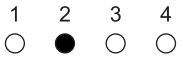
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

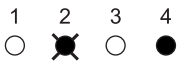
Time allowed: 30 minutes

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.

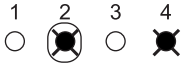
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 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 molecules of ammonia.

The formula for ammonia is NH_3

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

A elements

B electrons

C atoms

D bonds

The formula tells us that one molecule of ammonia contains three . . . **1** . . . of hydrogen.

In ammonia, the particles of nitrogen and hydrogen are joined together by . . . **2** . . . which are formed by sharing . . . **3** . . . between the nitrogen and hydrogen.

Nitrogen and hydrogen are both . . . **4** . . . .

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QUESTION TWO

Impure iron is produced in a blast furnace by reducing the iron compound found in one of its ores.

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

A carbon

B cast iron

C iron

D iron oxide

The main ore from which iron is extracted contains the compound . . . **1** . . . .

This is reduced in the blast furnace by reacting it with . . . **2** . . . .

The metal produced from the blast furnace contains about 96% . . . **3** . . . .

The product is brittle and is known as . . . **4** . . . .

Turn over for the next question

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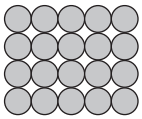
QUESTION THREE

The diagrams show the arrangement of atoms in each of four substances, **A**, **B**, **C** and **D**, at room temperature (20 °C).

Substance **A**



Substance **B**



Substance **C**



Substance **D**



Key

- An atom of oxygen
- An atom of carbon
- An atom of iron
- An atom of hydrogen

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

	Description of the substance
1	It is an element that is a gas.
2	It is an element that is a solid.
3	It is a compound that is a gas.
4	It is a compound that is a liquid.

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QUESTION FOUR

This question is about four elements, **A**, **B**, **C** and **D**.

	Melting point in °C	Boiling point in °C	Density in g per cm^3	Electrical conductivity
A	64	774	0.9	good
B	–218	–183	0.00014	very poor
C	–39	357	13.6	very good
D	115	444	2.1	very poor

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

	Property of the element
1	It is the element with the highest melting point.
2	It is a gas at room temperature (20 °C).
3	It is the metal with the lowest density.
4	It is the metal that is liquid at room temperature (20 °C).

Turn over for the next question

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QUESTION FIVE

Fuels burn in air to form oxides of the elements they contain.
When fuel molecules contain a large number of carbon atoms, combustion is not always complete.
With incomplete combustion, carbon particles may be produced.

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

A H_2

B CO

C C_4H_{10}

D $C_{14}H_{28}$

1	It will burn to form carbon dioxide only.
2	It will burn to form water only.
3	It is an alkane.
4	It will probably contribute to global dimming when burned.

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Turn over for the next question

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SECTION TWO

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

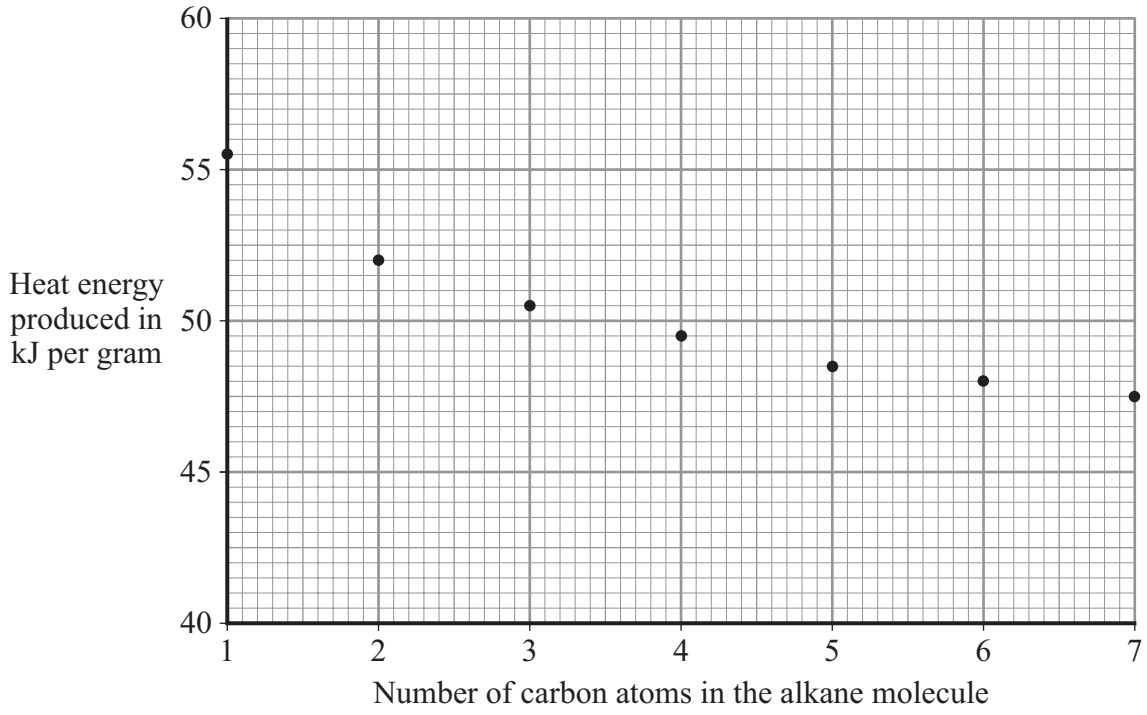
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

The graph shows how much heat energy is produced when one gram of each of seven alkanes is burned.



6A How much heat energy is produced by burning one gram of the alkane with two carbon atoms in its molecule?

1 51 kJ

2 52 kJ

3 53 kJ

4 54 kJ

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6B The alkane that produces the most heat energy per gram, when burned, is the alkane with . . .

1 one carbon atom in its molecule.

2 three carbon atoms in its molecule.

3 five carbon atoms in its molecule.

4 seven carbon atoms in its molecule.

6C Carbon dioxide is produced when hydrocarbon fuels burn.

This is a problem because carbon dioxide . . .

1 dissolves in rainwater.

2 reacts with oxygen to form carbon monoxide.

3 may cause global warming.

4 may cause global dimming.

6D Petrol companies have reduced the amount of sulfur in petrol and diesel fuels.

The main reason is . . .

1 to reduce their production costs.

2 to reduce the amount of carbon dioxide released into the atmosphere.

3 to reduce the acidity of rain.

4 to reduce the amount of fuel used in vehicles.

Turn over for the next question

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QUESTION SEVEN

A student designed an experiment to find the mass of calcium oxide that could be obtained from 5.00 g of calcium carbonate.

He heated 5.00 g of calcium carbonate in a test tube with a Bunsen burner. The mass of the contents remaining in the test tube was recorded every minute.

He repeated the experiment with another 5.00 g of calcium carbonate.

The results are shown in the table.

	Time in minutes	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Mass of the contents of the test tube in g	Test 1	5.00	4.81	4.23	3.85	3.43	3.08	2.96
	Test 2	5.00	4.55	3.97	3.36	2.92	2.80	2.80

7A To improve the reliability of the results, the student should . . .

1 use a more precise balance.

2 repeat the investigation at least one more time.

3 use a greater mass of calcium carbonate.

4 measure the mass of carbon dioxide released during heating.

7B One variable that is difficult to control in this experiment is . . .

1 the mass of the calcium carbonate.

2 the mass of the test tube.

3 the time for which the calcium carbonate is heated.

4 the temperature of the Bunsen burner flame.

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7C The student wants an accurate result for the mass of calcium oxide that forms from 5.00 g of calcium carbonate.

He should . . .

1 take readings at shorter time intervals.

2 remove the calcium oxide from the tube to find the mass.

3 use a larger test tube so that the carbon dioxide given off does not escape.

4 heat the calcium carbonate until there is no further loss in mass.

7D This is the word equation for the decomposition of calcium carbonate:

$$\text{calcium carbonate} \rightarrow \text{calcium oxide} + \text{carbon dioxide}$$

When 5.00 g of calcium carbonate is heated, 2.80 g of calcium oxide is left.

How much carbon dioxide has been given off?

1 2.20 g

2 2.80 g

3 5.00 g

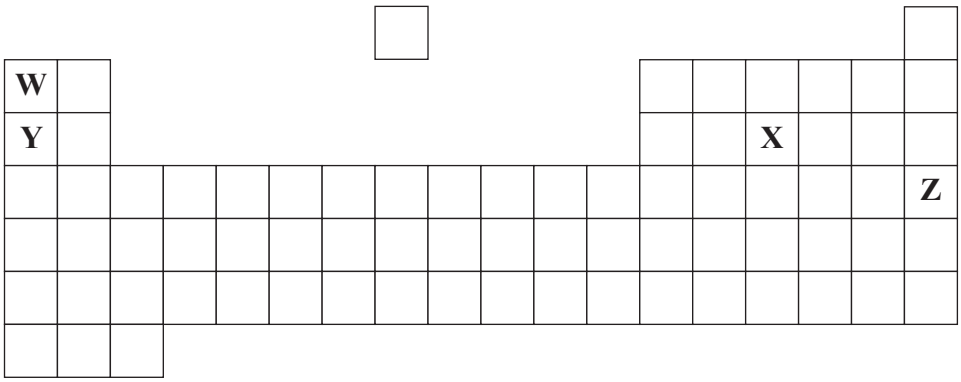
4 7.80 g

Turn over for the next question

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QUESTION EIGHT

The diagram represents the periodic table.



Four elements, **W**, **X**, **Y** and **Z**, are shown. The letters representing these elements are **not** their chemical symbols.

8A Which elements have chemical properties similar to element **W**?

1 both elements **X** and **Y**

2 only element **X**

3 only element **Y**

4 only element **Z**

8B What are the vertical columns called in the periodic table?

1 compounds

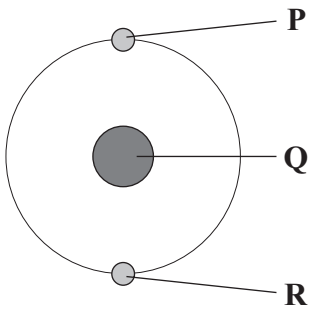
2 groups

3 periods

4 tables

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8C The diagram shows an atom.



Which row in the table is correct?

	P	Q	R
1	electron	nucleus	electron
2	electron	nucleus	nucleus
3	nucleus	electron	electron
4	nucleus	nucleus	electron

8D In a chemical reaction, . . .

1 new types of atom are produced.

2 more atoms are produced.

3 the atoms rearrange themselves.

4 some atoms are lost.

Turn over for the next question

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QUESTION NINE

Solder is an alloy of lead and tin. The table shows how the percentage of tin affects some of the properties of solder.

Percentage of tin	Tensile strength in MPa	Melting point in °C	Density in g per cm^3
0	12	347	11.35
10	30	297	10.50
20	33	257	10.40
30	34	217	9.66
40	37	187	9.28
50	41	147	8.90
60	52	153	8.52
70	54	167	8.17

9A What is the density of lead in g per cm^3?

1 8.17

2 8.90

3 11.35

4 12.00

9B Increasing the percentage of tin in solder . . .

1 decreases the tensile strength of the solder.

2 decreases the density of the solder.

3 increases the flexibility of the solder.

4 increases the melting point of the solder.

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9C How could the lowest melting point of solder be found accurately?

1 by using a more accurate type of thermometer

2 by repeating the measurements between 30 % and 50 % tin

3 by increasing the number of measurements between 40 % and 60 % tin

4 by increasing the number of measurements between 50 % and 70 % tin

9D How might the relationship between the percentage of tin in solder and the melting point of solder best be described?

1 The relationship is directly proportional.

2 There is no relationship.

3 As the percentage of tin increases, the melting point decreases steadily.

4 As the percentage of tin increases, the melting point decreases, and then starts to rise.

END OF TEST

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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

Fuels burn in air to form oxides of the elements they contain.
When fuel molecules contain a large number of carbon atoms, combustion is not always complete.
With incomplete combustion, carbon particles may be produced.

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

A H_2

B CO

C C_4H_{10}

D $C_{14}H_{28}$

1	It will burn to form carbon dioxide only.
2	It will burn to form water only.
3	It is an alkane.
4	It will probably contribute to global dimming when burned.

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QUESTION TWO

This question is about the production of metals.

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

A decomposed

B acidified

C reduced

D extracted

Some metals are produced from their carbonate ores.

The ores are first . . . **1** . . . from the ground.

They are then heated until the metal carbonate is . . . **2** . . . .

When the ore is heated, sulfur impurities may react with air and eventually cause rainwater to be . . . **3** . . . .

Finally, the metal oxide can be reacted with carbon and so be . . . **4** . . . to the metal.

Turn over for the next question

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SECTION TWO

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

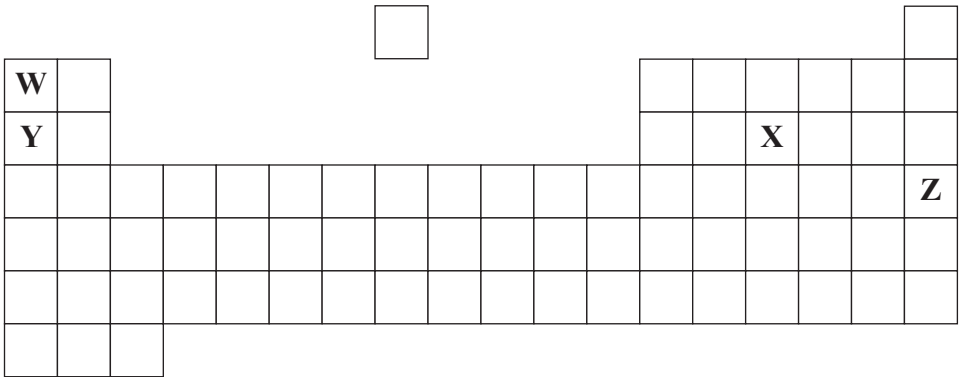
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In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

The diagram represents the periodic table.



Four elements, **W**, **X**, **Y** and **Z**, are shown. The letters representing these elements are **not** their chemical symbols.

3A Which elements have chemical properties similar to element **W**?

1 both elements **X** and **Y**

2 only element **X**

3 only element **Y**

4 only element **Z**

3B What are the vertical columns called in the periodic table?

1 compounds

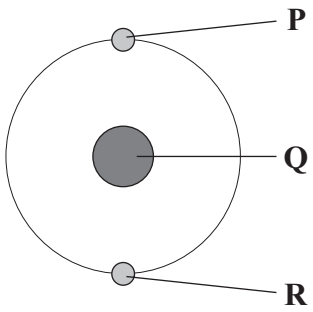
2 groups

3 periods

4 tables

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3C The diagram shows an atom.



Which row in the table is correct?

	P	Q	R
1	electron	nucleus	electron
2	electron	nucleus	nucleus
3	nucleus	electron	electron
4	nucleus	nucleus	electron

3D In a chemical reaction, . . .

1 new types of atom are produced.

2 more atoms are produced.

3 the atoms rearrange themselves.

4 some atoms are lost.

Turn over for the next question

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QUESTION FOUR

Solder is an alloy of lead and tin. The table shows how the percentage of tin affects some of the properties of solder.

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0	12	347	11.35
10	30	297	10.50
20	33	257	10.40
30	34	217	9.66
40	37	187	9.28
50	41	147	8.90
60	52	153	8.52
70	54	167	8.17

4A What is the density of lead in g per cm^3?

1 8.17

2 8.90

3 11.35

4 12.00

4B Increasing the percentage of tin in solder . . .

1 decreases the tensile strength of the solder.

2 decreases the density of the solder.

3 increases the flexibility of the solder.

4 increases the melting point of the solder.

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4C How could the lowest melting point of solder be found accurately?

1 by using a more accurate type of thermometer

2 by repeating the measurements between 30 % and 50 % tin

3 by increasing the number of measurements between 40 % and 60 % tin

4 by increasing the number of measurements between 50 % and 70 % tin

4D How might the relationship between the percentage of tin in solder and the melting point of solder best be described?

1 The relationship is directly proportional.

2 There is no relationship.

3 As the percentage of tin increases, the melting point decreases steadily.

4 As the percentage of tin increases, the melting point decreases, and then starts to rise.

Turn over for the next question

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QUESTION FIVE

This question is about heating some metal carbonates.

A student heated exactly 1.00 g of four different metal carbonates. He heated them strongly for exactly the same amount of time. He used the same balance for each measurement.

After heating with a Bunsen burner, the masses remaining were:

calcium carbonate	0.56 g
copper carbonate	0.64 g
magnesium carbonate	0.48 g
sodium carbonate	1.00 g

5A What is the most likely reason why sodium carbonate had the same mass after heating?

1 The balance was not working properly.

2 Sodium carbonate does not decompose at Bunsen burner temperatures.

3 The student did not heat the sodium carbonate long enough.

4 The student used too much sodium carbonate so it was not all heated.

5B When copper carbonate is heated, it changes from a green powder to a black powder.

What is the black powder?

1 carbon

2 copper

3 copper hydroxide

4 copper oxide

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Four students, **A**, **B**, **C** and **D**, heated copper carbonate. The table shows their results.

Student	Mass of copper carbonate used in g	Mass after heating in g
A	0.50	0.32
B	0.60	0.38
C	0.70	0.40
D	0.80	0.51

5C Which student obtained an anomalous result?

1 Student **A**

2 Student **B**

3 Student **C**

4 Student **D**

5D The student with the anomalous result thought that he had not heated the copper carbonate long enough for the reaction to finish. He repeated the experiment.

What is the best method he could use to make sure that the reaction had finished?

1 heat the copper carbonate for twice as long

2 heat the copper carbonate until he could not see any more green colour

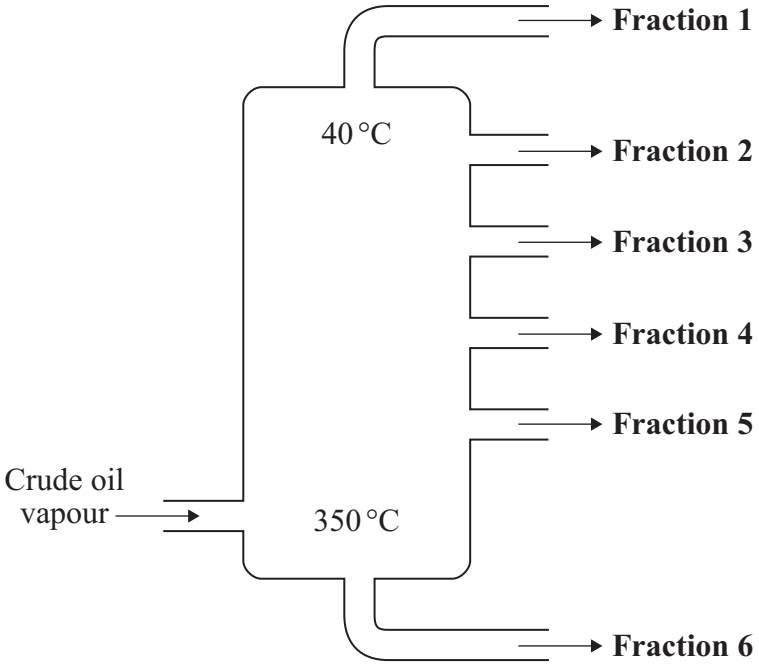
3 heat the copper carbonate until it did not lose any more mass

4 heat the copper carbonate until carbon dioxide is detected coming from the tube

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QUESTION SIX

Crude oil vapour can be separated into a number of fractions.



6A Crude oil vapour enters the fractionating column.

What happens as the vapour cools?

1 The fractions separate because they have different densities.

2 The fractions condense at 40 °C.

3 The fractions condense at different temperatures.

4 The fractions condense at 350 °C.

6B **Fraction 6** will contain . . .

1 alkanes with high boiling points.

2 alkanes with a small number of carbon atoms in each molecule.

3 only hydrocarbons that are unsaturated.

4 only hydrocarbons with low boiling points.

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6C **Fraction 1** contains the alkanes called methane, ethane, propane and butane.

By what process could pure methane be obtained from this fraction?

1 evaporation

2 electrolysis

3 thermal decomposition

4 fractional distillation

6D Which of these statements is correct for the alkanes?

1 They are a series of compounds with the general formula C_nH_{2n+1}

2 They are saturated compounds.

3 Most are gases at room temperature (20 °C), some are liquids, none are solids.

4 Their molecules have a carbon : hydrogen ratio of 1 : 4

Turn over for the next question

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QUESTION SEVEN

Calcium carbonate decomposes on heating to give calcium oxide and carbon dioxide.

$$CaCO_3 \rightarrow CaO + CO_2$$

100 g of calcium carbonate, on complete decomposition, produces 56 g of calcium oxide.

If the carbon dioxide is not allowed to escape, it will recombine with the calcium oxide. This can happen at any temperature.

The carbon dioxide formed could be:

- used by oil companies
- used by ice-cream companies
- reacted with sodium hydroxide to make sodium carbonate for glass-making.

7A Calculate the mass of carbon dioxide that would be released by completely decomposing 400 tonnes of calcium carbonate.

(1 tonne = 1 000 000 g)

1 17.6 tonnes

2 22.4 tonnes

3 176.0 tonnes

4 224.0 tonnes

7B If calcium oxide is left exposed to the air, it will increase in mass.

Which of the following could **not** be the reason for this?

1 The calcium oxide is recombining with carbon dioxide from the air.

2 The calcium oxide is reacting with water from the air.

3 The calcium oxide is still thermally decomposing.

4 The calcium oxide is reverting back to calcium carbonate.

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7C A company makes calcium oxide from calcium carbonate.

The best way for this company to benefit economically, and at the same time reduce environmental damage, is to . . .

1 store the carbon dioxide in holes in the ground made by oil companies.

2 offer the carbon dioxide to oil companies so that they can use it to flush oil out of the ground.

3 sell solid carbon dioxide to ice-cream companies for keeping ice-cream cold.

4 sell the carbon dioxide to glass-making companies for conversion into sodium carbonate.

7D Graphs of global temperatures compared with the amount of carbon dioxide in the atmosphere over the past 50 years follow each other very closely.

The best conclusion that can be drawn from this is that . . .

1 burning fossil fuels causes global warming.

2 decomposing limestone causes global warming.

3 the heat from processing limestone causes global warming.

4 rising levels of carbon dioxide probably add to global warming.

Turn over for the next question

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QUESTION EIGHT

This question is about cyclic alkanes. Cyclic alkanes have similar chemical properties to straight chain alkanes.

The table below gives the energy released by burning the first four cyclic alkanes.

Cyclic alkane	Formula	Energy released by burning 1 g of the cyclic alkane
Cyclopropane	C_3H_6	46.6 kJ
Cyclobutane	C_4H_8	45.9 kJ
Cyclopentane	C_5H_{10}	44.3 kJ
Cyclohexane	C_6H_{12}	43.9 kJ

8A The cyclic alkanes listed in the table all fit the general formula . . .

1 CH_2

2 C_nH_{2n}

3 C_nH_{2n+2}

4 C_nH_{n+2}

8B Burning cyclic alkanes could **not** produce . . .

1 carbon.

2 hydrogen.

3 carbon dioxide.

4 water.

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8C A graph of the energy released by burning cyclic alkanes (y-axis) against the number of carbon atoms they contain (x-axis), would involve plotting . . .

1 an independent variable against a discrete variable.

2 a continuous variable against a continuous variable.

3 a discrete variable against a control variable.

4 a continuous variable against a discrete variable.

8D A graph of the energy released by burning cyclic alkanes (y-axis) against the number of carbon atoms they contain (x-axis), would show . . .

1 negative correlation.

2 no clear pattern.

3 positive correlation.

4 direct proportionality.

Turn over for the next question

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QUESTION NINE

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.

9A 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**

9B Which metal is most likely to be found in the ground as the pure metal?

1 **W**

2 **X**

3 **Y**

4 **Z**

9C How would metal **Z** be produced?

1 by mixing the oxide of **Z** with carbon and heating

2 by mixing an oxide of **Z** with the metal **W** and heating

3 by electrolysis of a molten oxide of **Z**

4 by heating the oxide of **Z** in a stream of hydrogen gas

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9D The equation for the reduction of the oxide of **W** to the metal **W** can be represented by the following equation:

$$2\mathbf{W}_2O_3 \quad + \quad \boldsymbol{q}C \quad = \quad 3CO_2 \quad + \quad \boldsymbol{r}\mathbf{W}$$

What values of ***q*** and ***r*** are needed to balance the equation?

1 ***q*** = 3 and ***r*** = 4

2 ***q*** = 2 and ***r*** = 2

3 ***q*** = 4 and ***r*** = 2

4 ***q*** = 3 and ***r*** = 2

END OF TEST

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Version 1:0: 06/01/09

ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A (4461)

Specification A

CHY1AP, CH1ASF & CH1ASH

Mark Scheme

2009 Examination – March Series

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Dr Michael Cresswell Director General

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GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

March 2009

Foundation Tier

Question	Key		
One	**A**	elements	**4**
	B	electrons	**3**
	C	atoms	**1**
	D	bonds	**2**
Two	**A**	carbon	**2**
	B	cast iron	**4**
	C	iron	**3**
	D	iron oxide	**1**
Three	**A**	Substance **A**	**1**
	B	Substance **B**	**2**
	C	Substance **C**	**3**
	D	Substance **D**	**4**
Four	**A**	Element **A**	**3**
	B	Element **B**	**2**
	C	Element **C**	**4**
	D	Element **D**	**1**
Five	**A**	Molecule **A**	**2**
	B	Molecule **B**	**1**
	C	Molecule **C**	**3**
	D	Molecule **D**	**4**

	A	**B**	**C**	**D**
Six	**2**	**1**	**3**	**3**
Seven	**2**	**4**	**4**	**1**
Eight	**3**	**2**	**1**	**3**
Nine	**3**	**2**	**3**	**4**

GCSE

SCIENCE A (4461)/CHEMISTRY (4421)

Objective Test Answer Key

CHY1AP (Products from Rocks)

March 2009

Higher Tier

Question	*Key*		
One	**A**	Molecule **A**	**2**
	B	Molecule **B**	**1**
	C	Molecule **C**	**3**
	D	Molecule **D**	**4**
Two	**A**	decomposed	**2**
	B	acidified	**3**
	C	reduced	**4**
	D	extracted	**1**

	A	**B**	**C**	**D**
Three	**3**	**2**	**1**	**3**
Four	**3**	**2**	**3**	**4**
Five	**2**	**4**	**3**	**3**
Six	**3**	**1**	**4**	**2**
Seven	**3**	**3**	**4**	**4**
Eight	**2**	**2**	**4**	**1**
Nine	**2**	**2**	**3**	**1**