

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.

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

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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**.

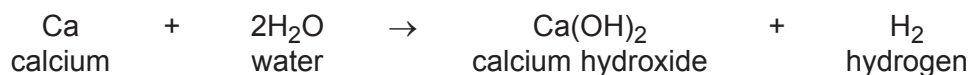
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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.



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

H₂ represents one . . . **3** . . . of hydrogen

Ca(OH)₂ is the . . . **4** . . . for calcium hydroxide.

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 cm³	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.

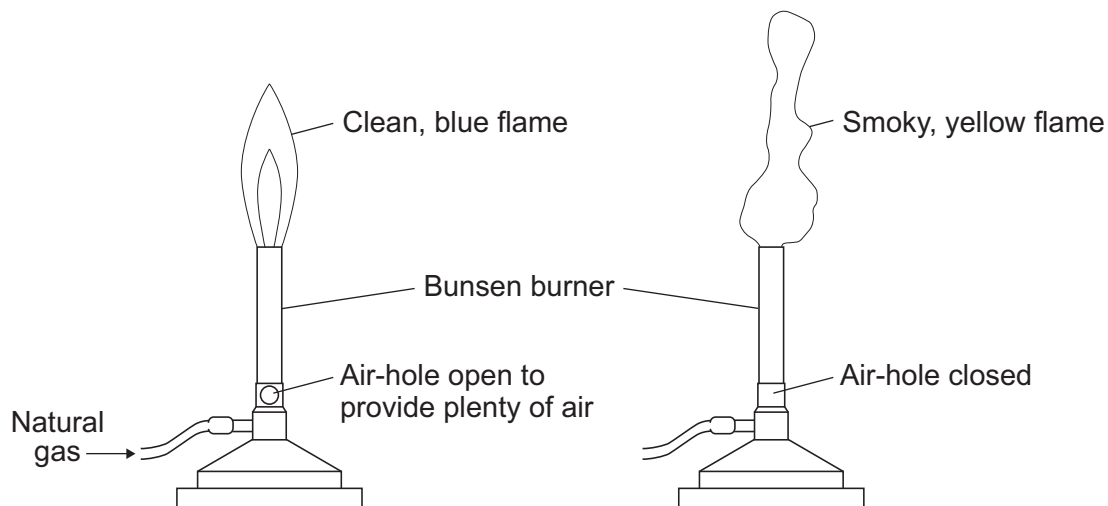
Turn over for the next question

Turn over ►

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**

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.

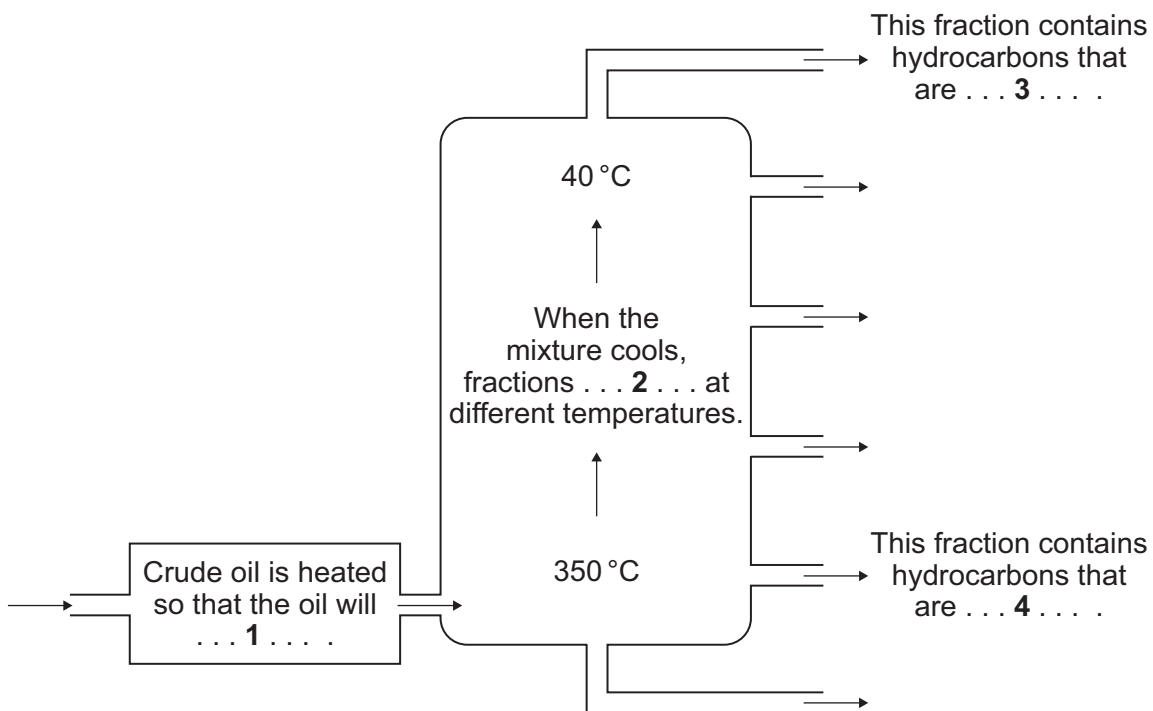
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QUESTION FIVE

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



Turn over for the next question

Turn over ►

Section TwoQuestions **SIX** to **NINE**.

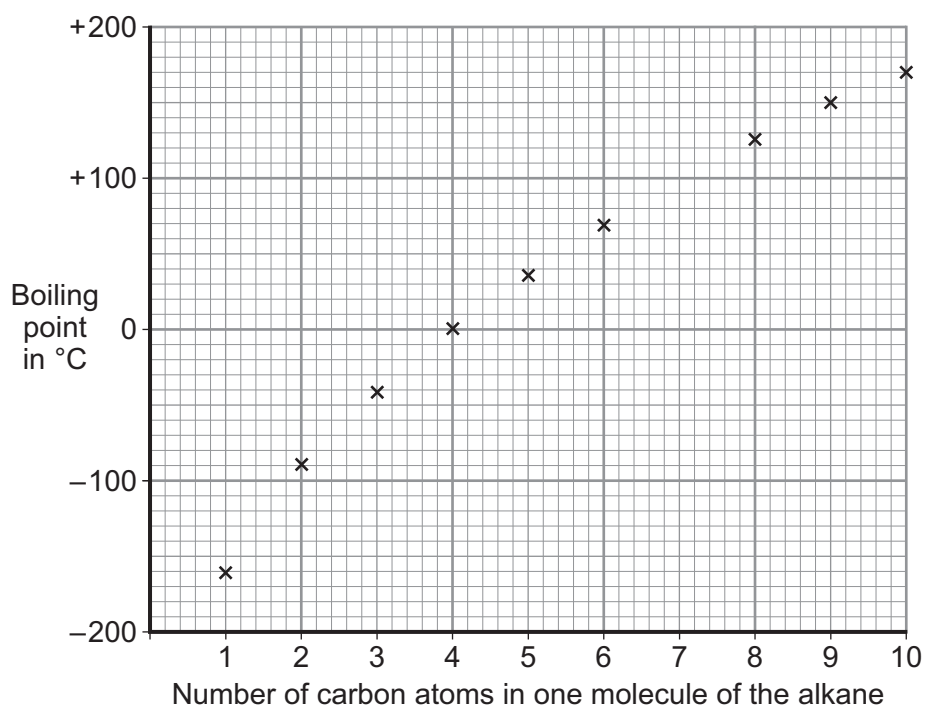
Each of these questions has four parts.

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.

-
- 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 $\text{C}_{10}\text{H}_{22}$
 - 4 C_9H_{20} and $\text{C}_{10}\text{H}_{22}$
- 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.

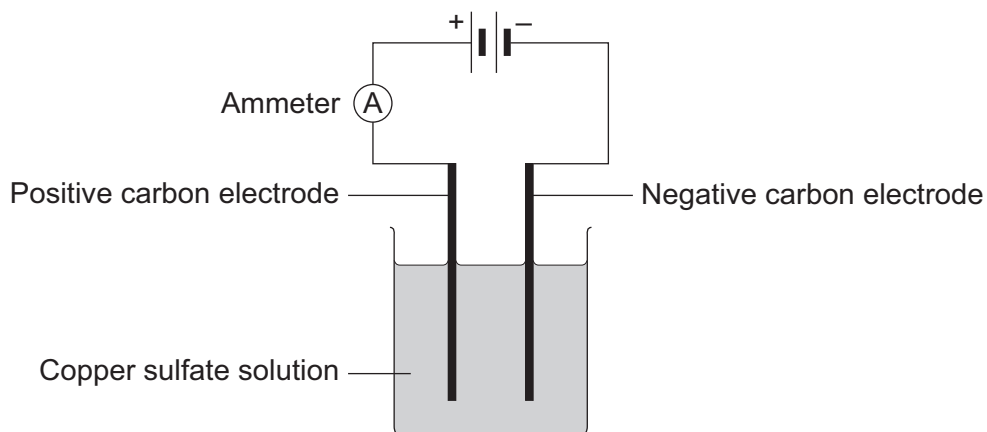
Turn over for the next question

Turn over ►

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

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.

Turn over ►

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

Turn over ►

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

9D What is the black powder?

- 1 copper
- 2 copper oxide
- 3 carbon
- 4 calcium oxide

END OF TEST

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

HIGHER TIER

Section One

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

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

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

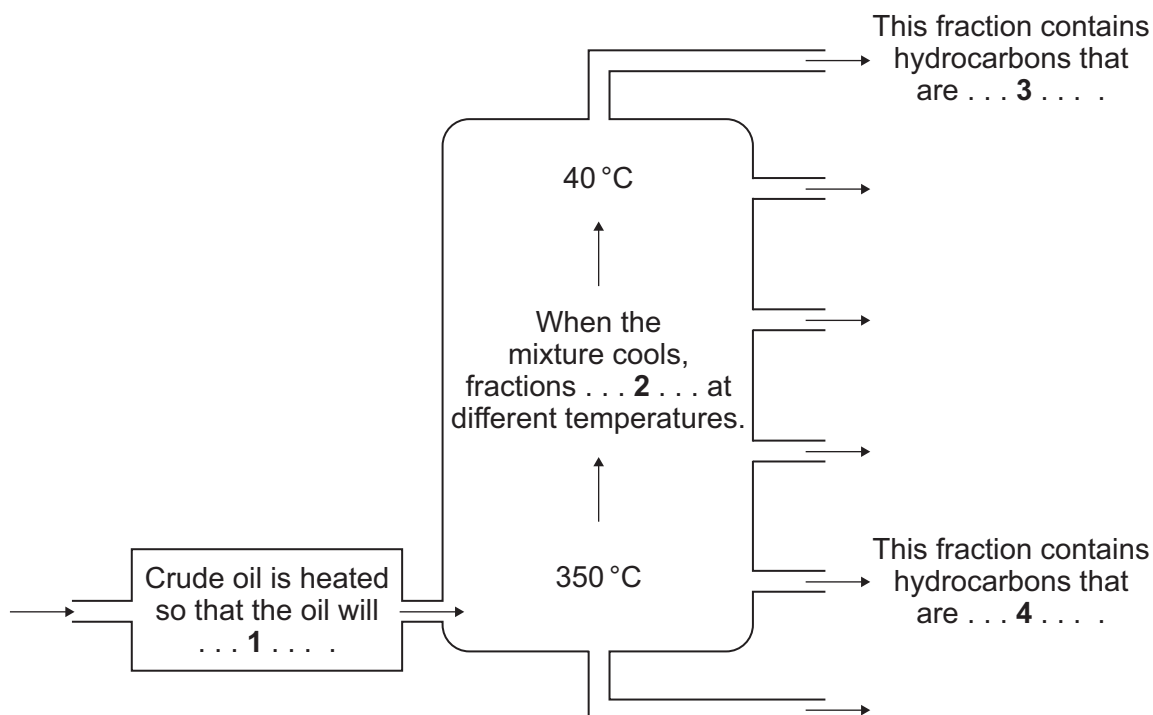
Mark your choices on the answer sheet.

QUESTION ONE

This question is about fractional distillation of crude oil.

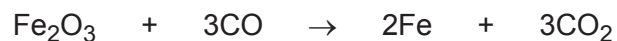
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences on the diagram.

- A** condense
- B** vaporise
- C** viscous
- D** volatile



QUESTION TWO

The balanced equation for a reaction of iron oxide is:



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

Turn over ►

- 3C** 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

- 3D** 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

Turn over ►

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

4D What is the black powder?

- 1 copper
- 2 copper oxide
- 3 carbon
- 4 calcium oxide

Turn over for the next question

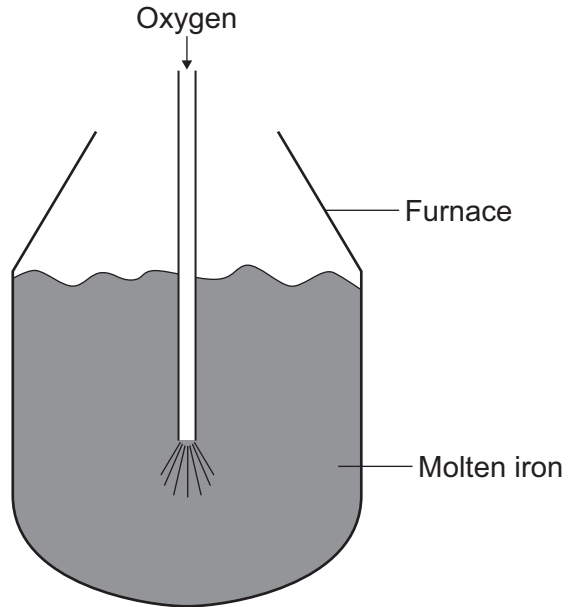
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QUESTION FIVE

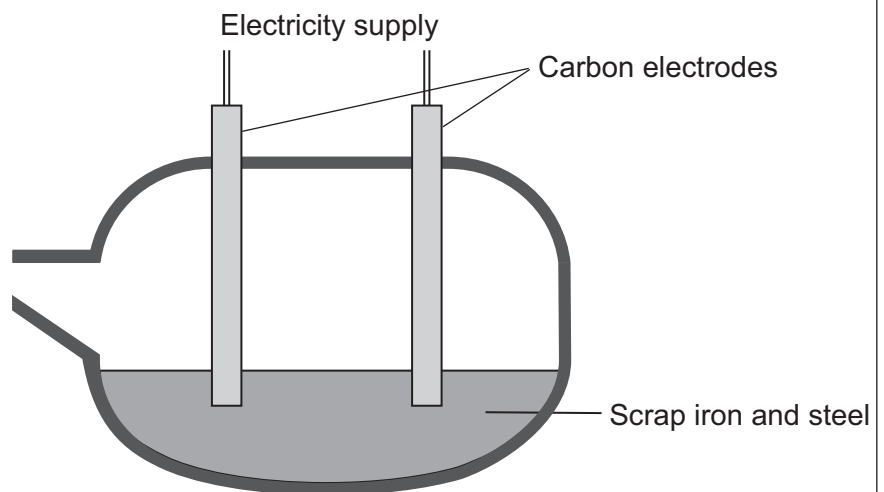
The diagrams show two processes for making steel.

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.



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.

Turn over ►

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?

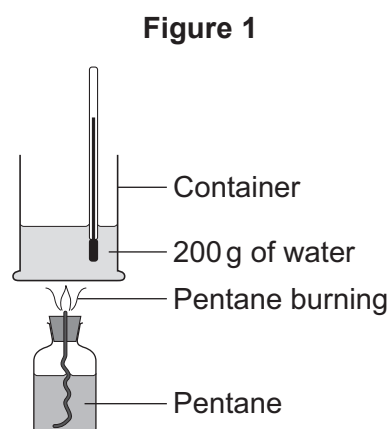
- 1 the chemical formula of pentane
- 2 the number of water molecules produced by burning one molecule of pentane
- 3 the number of bonds in one molecule of pentane
- 4 the number of carbon dioxide molecules produced by the incomplete combustion of one molecule of pentane

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.



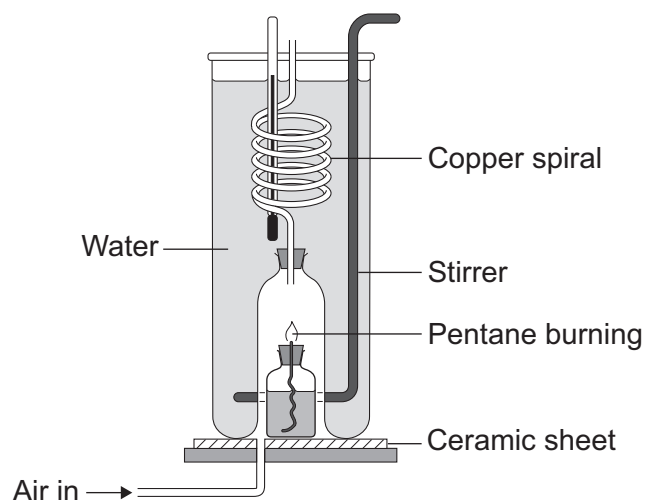
From these results, the student calculated the energy released to be 27.9 kJ per gram of pentane.

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.

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.

Turn over ►

QUESTION SEVEN

The alkanes are a series of compounds.

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

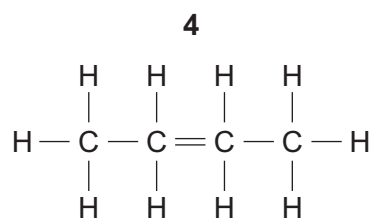
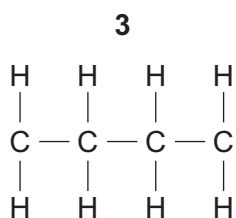
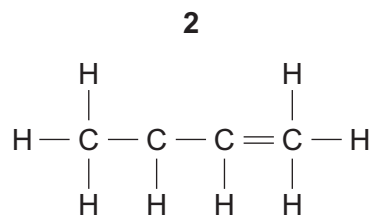
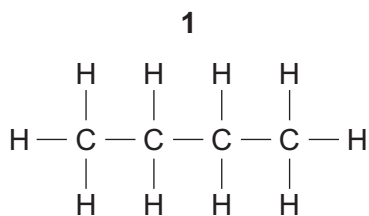
- 1 the general formula
- 2 the number of bonds on each carbon atom
- 3 the ratio of carbon atoms to hydrogen atoms
- 4 the number of elements present

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 . . .



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



Turn over for the next question

Turn over ►

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.

8D There are different views about future global temperatures.

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

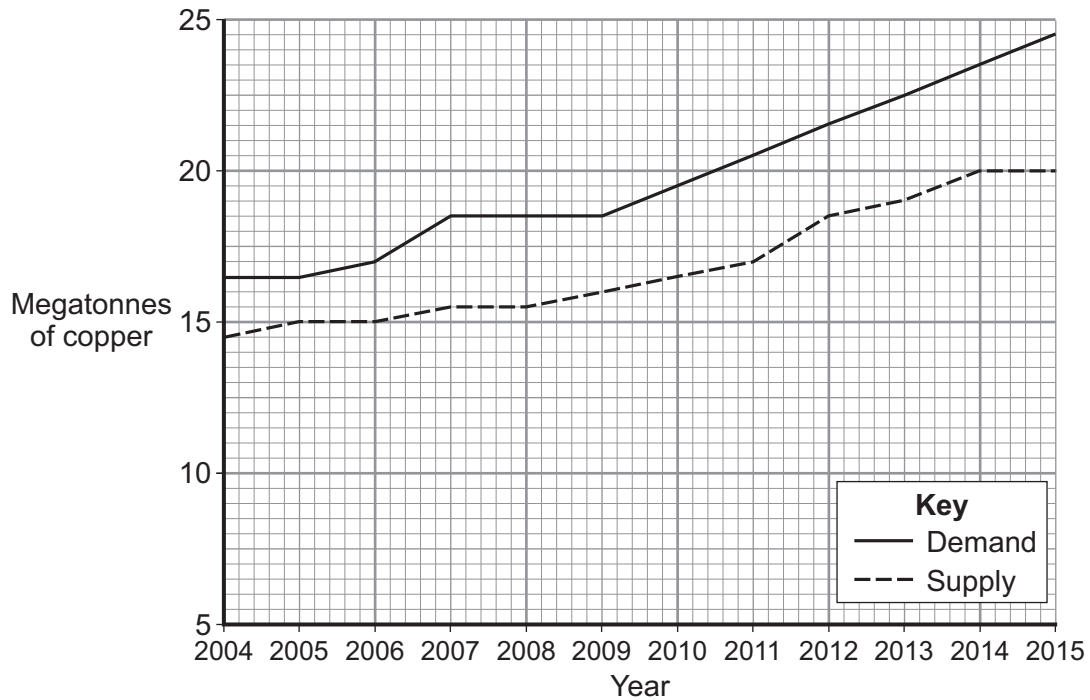
- 1 The future impact of volcanic activity cannot be predicted.
- 2 Some evidence may be ignored because of its political significance.
- 3 The data over the past 150 years show that global temperatures have been increasing.
- 4 Some researchers could be influenced by the company that employs them.

Turn over for the next question

Turn over ►

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.

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

There are no questions printed on this page