

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
November 2008



SCIENCE A
Unit Chemistry C1a (Products from Rocks)

CHY1AP

CHEMISTRY
Unit Chemistry C1a (Products from Rocks)

Thursday 20 November 2008 Morning Session

For this paper you must have:

- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

Time allowed: 30 minutes

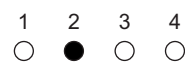
Instructions

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

Instructions for recording answers

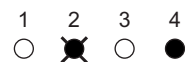
- Use a **black ball-point pen**.

- For each answer **completely fill in the circle** as shown:



- Do **not** extend beyond the circles.

- If you want to change your answer, **you must** cross out your original answer, as shown:



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



Information

- The maximum mark for this paper is 36.

Advice

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

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

FOUNDATION TIER

SECTION ONE

Questions **ONE** to **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 the industrial uses of limestone.

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

A decomposing

B heating

C quarrying

D building

Limestone is obtained from the ground by . . . **1**

Limestone itself is used as a material for . . . **2**

The energy needed to form quicklime from limestone is provided by . . . **3**

When limestone is being changed into quicklime, the limestone is . . . **4**

QUESTION TWO

This question is about elements.

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

- A** a nucleus
- B** a compound
- C** a group
- D** an element

An atom consists of electrons orbiting . . . **1**

A substance that is made up of only one kind of atom is called . . . **2**

In the periodic table, a vertical column is called . . . **3**

When two or more elements combine together, they form . . . **4**

QUESTION THREE

This question is about four of the gases given off when coal is heated in the absence of air.

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

- A** hydrogen, H_2
- B** ammonia, NH_3
- C** methane, CH_4
- D** carbon monoxide, CO

The gas that is an element is . . . **1**

The gas that is an alkane is . . . **2**

The gas that burns to form only carbon dioxide, CO_2 , is . . . **3**

The gas that has four atoms in its formula is . . . **4**

Turn over ►

QUESTION FOUR

This question is about copper and its alloys.

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

- A** a mixture
- B** expensive to extract from its ore
- C** a good conductor
- D** hard-wearing

It is worth recycling copper because it is . . . **1**

Copper is difficult to separate from an alloy because the alloy is . . . **2**

Bronze (a copper alloy), has been used for hundreds of years for making coins because it is . . . **3**

Copper is used for electrical wiring because it is . . . **4**

QUESTION FIVE

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

Alkane	Formula	Boiling point in °C
A	C_2H_6	-89
B	C_3H_8	-42
C	C_4H_{10}	0
D	C_5H_{12}	+36

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

The alkane with the structural formula
$$\begin{array}{ccccccc} & & \text{H} & & \text{H} & & \text{H} \\ & & | & & | & & | \\ \text{H} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{H} \\ & & | & & | & & | \\ & & \text{H} & & \text{H} & & \text{H} \end{array}$$
 is ... **1**

The alkane with the highest boiling point is ... **2**

The alkane that boils at the same temperature as ice melts is ... **3**

The alkane that is a gas at -50°C is ... **4**

Turn over for the next question

Turn over ►

SECTION TWOQuestions **SIX** to **NINE**.

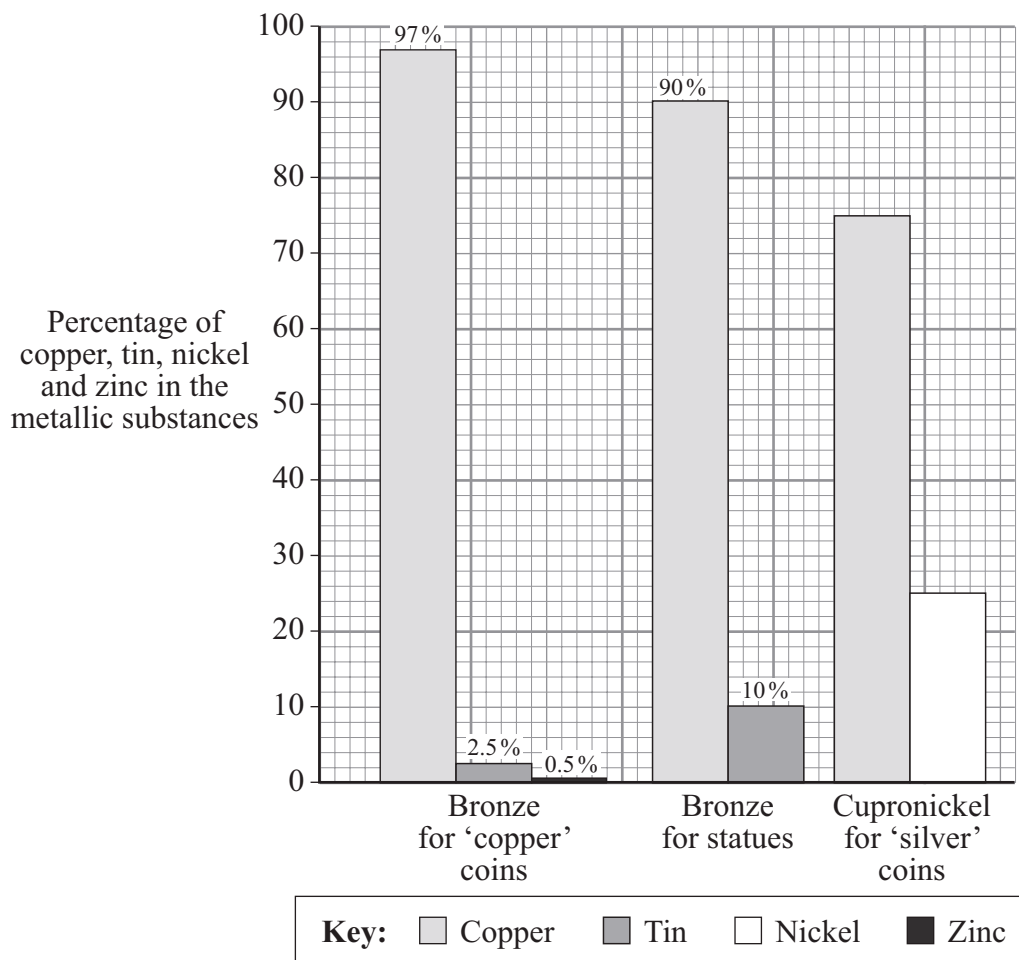
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

The bar chart shows the composition of three metallic substances.

**6A** Bronze and cupronickel are examples of . . .

- 1 compounds.
- 2 alloys.
- 3 elements.
- 4 ores.

6B ‘Silver’ coins are made from cupronickel.

What percentage of nickel do these coins contain?

- 1 10%
- 2 15%
- 3 25%
- 4 75%

6C Compared with bronze for ‘copper’ coins, the bronze used for statues contains . . .

- 1 a higher ratio of copper to tin.
- 2 four times as much tin.
- 3 less tin per 100 g of mixture.
- 4 more metal elements.

6D The most likely reason for recycling bronze is . . .

- 1 to conserve ore deposits.
- 2 to reclaim zinc.
- 3 that bronze statues are no longer made.
- 4 that the price of bronze has fallen.

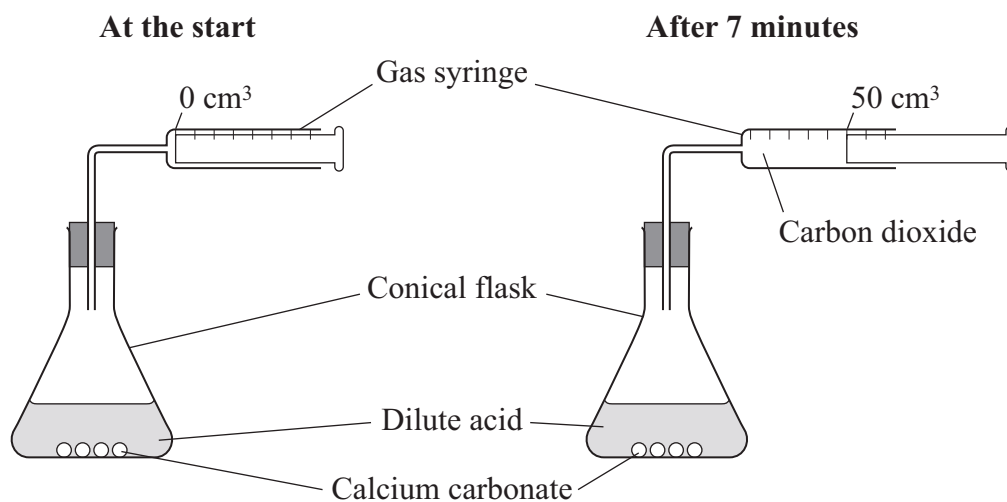
Turn over for the next question

Turn over ►

QUESTION SEVEN

Calcium carbonate reacts with a dilute acid to give off carbon dioxide gas.

The apparatus below was used to measure the volume of carbon dioxide given off.



The following results were obtained.

Time in minutes	Volume of gas in cm ³
0	0
1	20
2	30
3	40
4	45
5	50
6	50
7	50

7A During which period was the most carbon dioxide gas given off?

- 1 0–1 minutes
- 2 1–2 minutes
- 3 2–3 minutes
- 4 3–4 minutes

7B How long did it take for all the carbon dioxide gas to be given off?

- 1 4 minutes
- 2 5 minutes
- 3 6 minutes
- 4 7 minutes

7C Which of the following is the best reason for the volume of gas remaining at 50 cm³?

- 1 Both the calcium carbonate and the dilute acid had all reacted.
- 2 The calcium carbonate had all reacted.
- 3 The dilute acid had all reacted.
- 4 The gas syringe was full.

7D Which of the following actions would give a more precise value for the time that the reaction stopped?

- 1 using a larger conical flask
- 2 using a larger gas syringe
- 3 weighing the calcium carbonate before and after the experiment
- 4 measuring the volume of carbon dioxide gas every 30 seconds

Turn over ►

QUESTION EIGHT

Hydrocarbon fuels, **K**, **L**, **M** and **N**, were burned and the products were collected and identified.

The results are shown in the table below.

	Hydrocarbon fuels			
Products of burning	K	L	M	N
Carbon monoxide	✓	✓	✓	✗
Carbon dioxide	✓	✓	✓	✓
Water vapour	✓	✓	✓	✓
Soot	✓	✓	✗	✗
Sulfur dioxide	✗	✗	✓	✓

Key:

✓ indicates that the substance is one of the products

✗ indicates that the substance is **not** one of the products.

8A The results show that combustion was **only** complete for . . .

- 1 hydrocarbon fuel **K**.
- 2 hydrocarbon fuel **L**.
- 3 hydrocarbon fuel **M**.
- 4 hydrocarbon fuel **N**.

8B The table of results shows that the hydrocarbon fuels that do **not** contain sulfur are . . .

- 1 **M** and **N**.
- 2 **K** and **L**.
- 3 **L** and **M**.
- 4 **K** and **M**.

8C When hydrocarbon fuels are burned, some of the products cause problems.

Which one of the following statements correctly describes a problem that is caused by the products of burning?

- 1 Sulfur dioxide in the air causes heavier rainfall.
- 2 Releasing large amounts of carbon dioxide into the atmosphere produces 'acid rain'.
- 3 A build-up of particles in the air causes 'global dimming'.
- 4 Releasing large amounts of carbon dioxide into the atmosphere causes 'global dimming'.

8D Ethanol is a compound of carbon, hydrogen and oxygen.
Ethanol can be used as a fuel in vehicles together with, or in place of, hydrocarbon fuels.

An advantage of ethanol as a fuel is that when it burns . . .

- 1 no carbon dioxide is produced.
- 2 carbon dioxide and water are produced.
- 3 no sulfur dioxide is produced.
- 4 only water is produced.

Turn over for the next question

Turn over ►

QUESTION NINE

The extraction of iron involves heating a mixture of iron ore, limestone and coke (carbon) at high temperatures in a blast furnace.

The limestone and iron ore are extracted from large quarries, some of which are found in areas of outstanding natural beauty.

9A Some people are against the development of these large quarries.

One reason is that the quarries . . .

- 1 attract large numbers of tourists to visit the area.
- 2 make unsightly scars on the landscape.
- 3 are unnecessary because there are few uses for limestone.
- 4 create a dangerous habitat for wildlife.

9B Some people support the development of these quarries.

One reason is that the working quarries . . .

- 1 are always placed where the public cannot see them.
- 2 conserve resources.
- 3 provide employment for people who live in the area.
- 4 provide an area for leisure activities.

9C Iron is produced continuously, sometimes for several years without shutting down the blast furnace.

This is done . . .

- 1 because it is difficult to obtain large supplies of limestone.
- 2 because it takes several years to reach the required temperature in the furnace.
- 3 to minimise the energy costs.
- 4 to ensure that the iron is of the highest quality.

9D Some iron is obtained by recycling scrap iron.

Why does it take less energy to make iron from scrap iron than to extract the iron from its ore?

- 1 Scrap iron is an alloy.
- 2 Scrap iron contains the element sulfur.
- 3 Scrap iron does **not** have to be reduced using carbon.
- 4 Corrosion of the scrap iron makes it easier to melt.

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 four alkanes, **A**, **B**, **C** and **D**.

Alkane	Formula	Boiling point in °C
A	C_2H_6	–89
B	C_3H_8	–42
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D	C_5H_{12}	+36

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

The alkane with the structural formula
$$\begin{array}{ccccccc} & \text{H} & & \text{H} & & \text{H} & \\ & | & & | & & | & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - \text{H} \\ & | & & | & & | & \\ & \text{H} & & \text{H} & & \text{H} & \end{array}$$
 is ... **1** ...

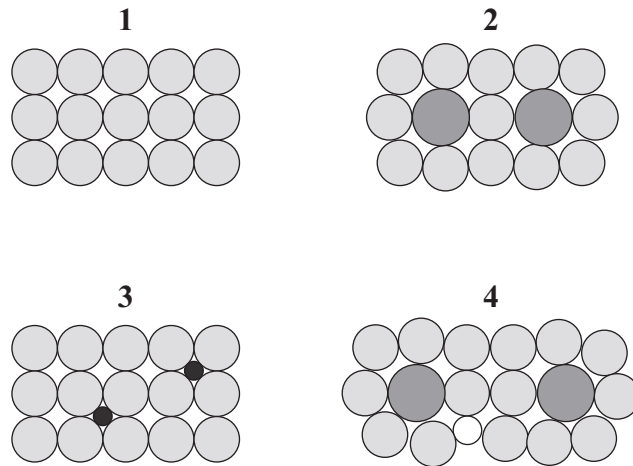
The alkane with the highest boiling point is ... **2** ...





The alkane that boils at the same temperature as ice melts is ... **3** ...

The alkane that is a gas at -50°C is ... **4** ...

QUESTION TWO

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



Key			
	Iron		Chromium
	Nickel		Carbon

Match statements, **A**, **B**, **C** and **D**, with the diagrams 1–4.

- A** It is a pure metal.
- B** It is the alloy that contains only two metals.
- C** It is a carbon steel alloy.
- D** It is the alloy that contains the largest number of different elements.

Turn over for the next question

Turn over ►

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

Hydrocarbon fuels, **K**, **L**, **M** and **N**, were burned and the products were collected and identified.

The results are shown in the table below.

	Hydrocarbon fuels			
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Soot	✓	✓	✗	✗
Sulfur dioxide	✗	✗	✓	✓

Key:

✓ indicates that the substance is one of the products

✗ indicates that the substance is **not** one of the products.

3A The results show that combustion was **only** complete for . . .

- 1 hydrocarbon fuel **K**.
- 2 hydrocarbon fuel **L**.
- 3 hydrocarbon fuel **M**.
- 4 hydrocarbon fuel **N**.

3B The table of results shows that the hydrocarbon fuels that do **not** contain sulfur are . . .

- 1 M and N.
- 2 K and L.
- 3 L and M.
- 4 K and M.

3C When hydrocarbon fuels are burned, some of the products cause problems.

Which one of the following statements correctly describes a problem that is caused by the products of burning?

- 1 Sulfur dioxide in the air causes heavier rainfall.
- 2 Releasing large amounts of carbon dioxide into the atmosphere produces ‘acid rain’.
- 3 A build-up of particles in the air causes ‘global dimming’.
- 4 Releasing large amounts of carbon dioxide into the atmosphere causes ‘global dimming’.

3D Ethanol is a compound of carbon, hydrogen and oxygen.

Ethanol can be used as a fuel in vehicles together with, or in place of, hydrocarbon fuels.

An advantage of ethanol as a fuel is that when it burns . . .

- 1 no carbon dioxide is produced.
- 2 carbon dioxide and water are produced.
- 3 no sulfur dioxide is produced.
- 4 only water is produced.

Turn over for the next question

Turn over ►

QUESTION FOUR

The extraction of iron involves heating a mixture of iron ore, limestone and coke (carbon) at high temperatures in a blast furnace.

The limestone and iron ore are extracted from large quarries, some of which are found in areas of outstanding natural beauty.

4A Some people are against the development of these large quarries.

One reason is that the quarries . . .

- 1 attract large numbers of tourists to visit the area.
- 2 make unsightly scars on the landscape.
- 3 are unnecessary because there are few uses for limestone.
- 4 create a dangerous habitat for wildlife.

4B Some people support the development of these quarries.

One reason is that the working quarries . . .

- 1 are always placed where the public cannot see them.
- 2 conserve resources.
- 3 provide employment for people who live in the area.
- 4 provide an area for leisure activities.

4C Iron is produced continuously, sometimes for several years without shutting down the blast furnace.

This is done . . .

- 1 because it is difficult to obtain large supplies of limestone.
- 2 because it takes several years to reach the required temperature in the furnace.
- 3 to minimise the energy costs.
- 4 to ensure that the iron is of the highest quality.

4D Some iron is obtained by recycling scrap iron.

Why does it take less energy to make iron from scrap iron than to extract the iron from its ore?

- 1 Scrap iron is an alloy.
- 2 Scrap iron contains the element sulfur.
- 3 Scrap iron does **not** have to be reduced using carbon.
- 4 Corrosion of the scrap iron makes it easier to melt.

Turn over for the next question

Turn over ►

QUESTION FIVE

Environmentalists say that the use of low-sulfur fuels is essential.
It is claimed that high sulfur dioxide levels in the air cause health problems such as asthma.

The table shows the number of deaths from asthma in five age groups from 1960 to 1995.

Year	Number of deaths from asthma for each age group				
	0–14	15–44	45–64	65–84	85 and above
1960	50	250	750	1230	1240
1965	100	700	1500	2030	2040
1970	50	250	700	1210	1230
1975	40	200	600	1180	1200
1980	40	200	660	1400	1450
1985	40	250	900	1770	1900
1990	30	200	650	1650	1800
1995	30	150	520	1200	1370
2000					

Sources:

ONS: www.statistics.gov.uk Reproduced under the terms of the Click-Use Licence.

Lung and Asthma Information Agency, St. Georges University of London: www.laia.co.uk

5A Which one of the following statements is true about deaths from asthma?

- 1 Values for all age groups increased and then decreased without a further increase.
- 2 The largest range of deaths occurred in the 0–14 age group.
- 3 Values for each age group peaked in 1965.
- 4 The values for each year always increased for any given age group.

- 5B** Which row in the table most accurately shows the expected deaths in Year 2000 if the trend from 1985 to 1995 continued?

	0–14	15–44	45–64	65–84	85 and above
1	30	100	460	950	1000
2	50	100	310	1250	1500
3	70	180	720	950	1000
4	30	150	520	1300	1400

- 5C** A doctor has noticed an increase in cases of asthma in his patients. He thinks it may be linked to the release of sulfur dioxide into the atmosphere from cars following the recent building of a new road near his surgery. He decides to carry out a survey to test his hypothesis.

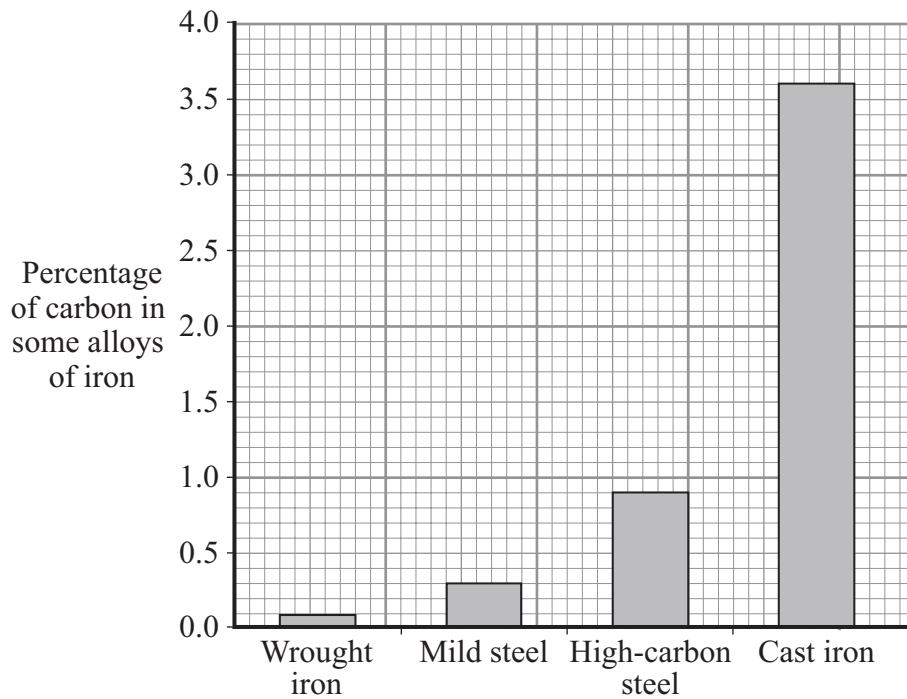
The best people to survey would be all his patients who . . .

- 1 drive and have breathing problems.
 - 2 live near the new road.
 - 3 are over 65 years old.
 - 4 drive to work.
- 5D** An improvement that the use of low-sulfur fuels should bring is . . .
- 1 less acid gas entering the atmosphere.
 - 2 a reduction in carbon emissions.
 - 3 a reduction in carbon monoxide emissions.
 - 4 less nitrogen entering the atmosphere.

Turn over ►

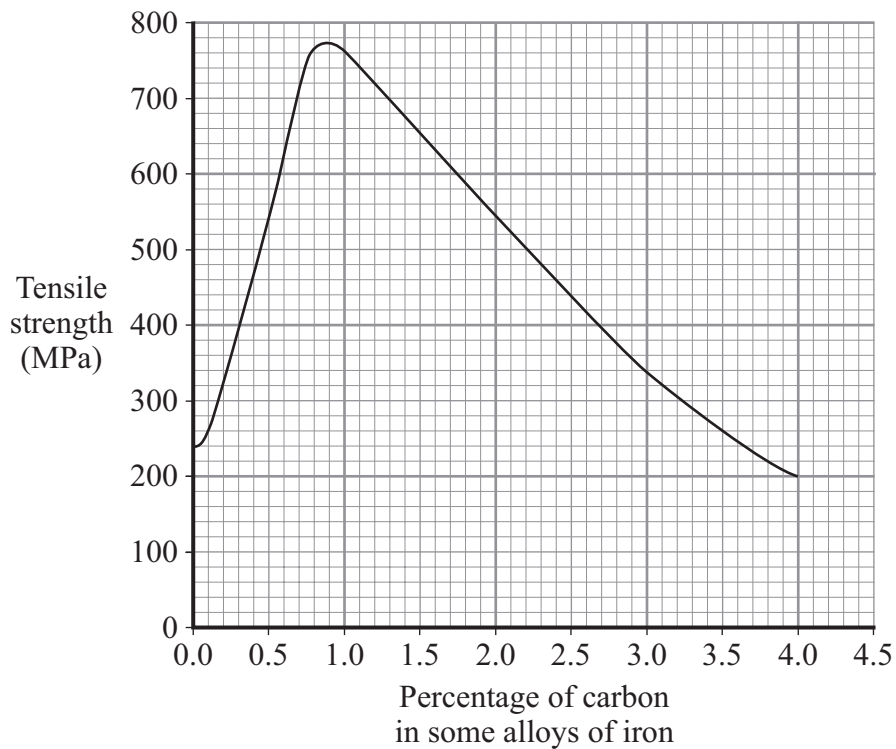
QUESTION SIX

The bar chart gives some information about the composition of some alloys of iron.



Tensile strength is a measure of the force needed to pull apart a piece of metal.

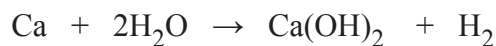
The graph shows the tensile strength of some alloys of iron.



-
- 6A** Which of the following best describes how the tensile strength changes as the carbon content increases?
- 1 It decreases.
 - 2 It decreases at first and then it increases.
 - 3 It increases.
 - 4 It increases at first and then it decreases.
- 6B** Which alloy has the lowest tensile strength?
- 1 cast iron
 - 2 high-carbon steel
 - 3 mild steel
 - 4 wrought iron
- 6C** High-carbon steel is best used to make wood-cutting tools such as chisels because . . .
- 1 it is hard and has a high tensile strength.
 - 2 it has a high tensile strength and is resistant to corrosion.
 - 3 it is easily shaped and is brittle.
 - 4 it is hard and is resistant to corrosion.
- 6D** Pure iron . . .
- 1 has atoms that are arranged in distorted layers.
 - 2 has many uses because it is hard and brittle.
 - 3 is soft and easily shaped.
 - 4 is used when resistance to corrosion is important.

QUESTION SEVEN

- Calcium reacts with water in this way:



- Magnesium reacts in a similar way.
- Neither calcium nor magnesium can be obtained from their oxides by carbon reduction.

7A Look at the equation for the reaction between calcium and water.

On each side of the equation, there is a total of . . .

- 1 2 compounds.
- 2 4 elements.
- 3 6 atoms.
- 4 7 atoms.

7B The information given suggests that calcium is . . .

- 1 more reactive than both hydrogen and carbon.
- 2 more reactive than hydrogen but less reactive than carbon.
- 3 less reactive than hydrogen but more reactive than carbon.
- 4 less reactive than either hydrogen or carbon.

7C Which of the following is a correctly balanced equation for the reaction between calcium and nitric acid?

- 1 $2\text{Ca} + 2\text{HNO}_3 \rightarrow 2\text{Ca}(\text{NO}_3)_2 + \text{H}_2$
- 2 $\text{Ca} + 2\text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2$
- 3 $2\text{Ca} + \text{HNO}_3 \rightarrow 2\text{Ca}(\text{NO}_3)_2 + \text{H}_2$
- 4 $\text{Ca} + 2\text{HNO}_3 \rightarrow 2\text{Ca}(\text{NO}_3)_2 + 2\text{H}_2$

7D Calcium and magnesium are both in Group 2 of the periodic table.

This suggests that . . .

- 1 they are two of about 100 non-metallic elements.
- 2 their carbonates are likely to decompose differently on heating.
- 3 they are likely to be extracted from their ores by similar methods.
- 4 their carbonates will form the metal oxide and oxygen on heating.

Turn over for the next question

Turn over ►

QUESTION EIGHT

Most titanium is extracted from titanium oxide ore. The oxide is first converted to titanium chloride. The titanium chloride is then reacted with sodium as shown in the word equation.



8A Titanium metal is produced in this reaction because . . .

- 1 titanium is more reactive than sodium.
- 2 titanium chloride decomposes at 500°C .
- 3 sodium is more reactive than titanium.
- 4 sodium chloride is a catalyst for this reaction.

8B This method of extracting titanium is expensive.

The amount of titanium that is recycled would probably be increased if . . .

- 1 the cost of sodium were to fall.
- 2 the cost of titanium were to fall.
- 3 new high-grade deposits of titanium oxide were discovered.
- 4 more uses for titanium were found.

8C Nitinol is a smart alloy made from titanium (55%) and nickel (45%).

Making 50 g of the alloy will require . . .

- 1 5 g of titanium and 45 g of nickel.
- 2 5 g of titanium and 22.5 g of nickel.
- 3 27.5 g of titanium and 22.5 g of nickel.
- 4 55 g of titanium and 45 g of nickel.

8D At room temperature (20 °C), nitinol can be stretched. If nitinol is then warmed, it contracts back to its original length.

Two possible uses of nitinol are in . . .

- 1 dental braces and spectacle frames.
- 2 dental braces and screwdrivers.
- 3 screwdrivers and jewellery.
- 4 jewellery and spectacle frames.

Turn over for the next question

Turn over ►

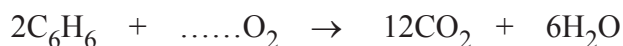
QUESTION NINE

Benzene is a chemical which used to be obtained from whale oil. It is now mainly manufactured from crude oil, but it can also be obtained from coal. It is an extremely useful substance in the chemical industry, but it is very toxic. The chemical formula for benzene is C_6H_6

9A Which of the following statements about benzene is true?

- 1 It is a hydrocarbon.
- 2 It is an alkane.
- 3 It is a mixture.
- 4 It is safe to use as a fuel.

9B The equation below for the combustion of benzene is **not** balanced.



How many oxygen molecules would be required to balance the equation?

- 1 12
- 2 15
- 3 18
- 4 30

9C Benzene burns with a very smoky flame, producing lots of soot.

This is because . . .

- 1 it is manufactured from crude oil.
- 2 it has very large molecules.
- 3 it has a high ratio of carbon to hydrogen atoms.
- 4 it is very toxic.

9D The price of benzene is increasing.

This could be because . . .

- 1 whales are harder to catch.
- 2 there is no demand for benzene.
- 3 it is obtained from a renewable resource.
- 4 the costs of crude oil and coal are rising.

END OF TEST