Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
June 2008

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

CHEMISTRY
Unit Chemistry C1a (Products from Rocks)

Monday 23 June 2008 Morning Session

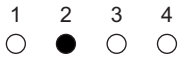
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

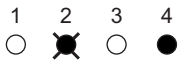
Time allowed: 30 minutes

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

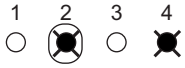
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



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



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



Information
- The maximum mark for this paper is 36.

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

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

FOUNDATION TIER

SECTION ONE

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

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

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

Mark your choices on the answer sheet.

QUESTION ONE

This question is about limestone.

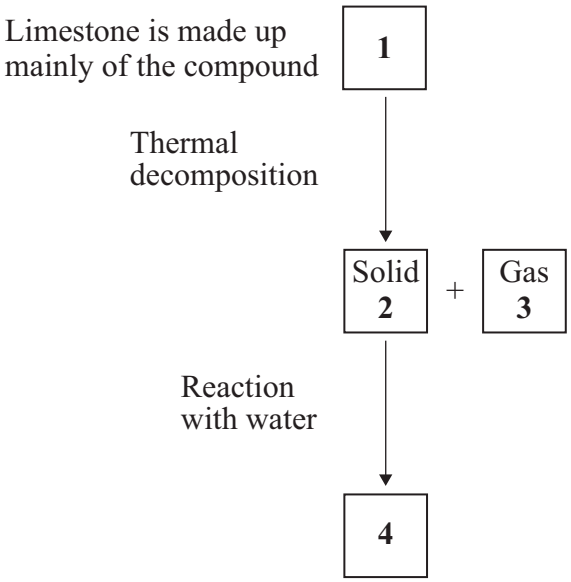
Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A calcium carbonate

B carbon dioxide

C calcium oxide

D slaked lime



QUESTION TWO

This question is about environmental problems caused by burning fuels.

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

A carbon dioxide

B smoke particles

C sulfur dioxide

D water vapour

	Environmental problem
1	acid rain
2	global dimming
3	global warming
4	no problems

Turn over for the next question

QUESTION THREE

The engine of a car is made of aluminium, to which other metals have been added to make it stronger. In the engine, petrol vapour burns as it reacts with oxygen. Petrol is made up of several alkanes.

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

A alkane

B engine

C oxygen

D petrol vapour

	Type of substance
1	mixture of metals
2	element
3	compound
4	mixture of gases

QUESTION FOUR

Metals are used for different purposes depending on their properties.

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

A a good conductor of electricity

B easy to bend when hot

C resistant to corrosion

D very easily worn away

Iron is used for making garden gates because it is . . . **1** . . . .

Aluminium is used for window frames because it is . . . **2** . . . .

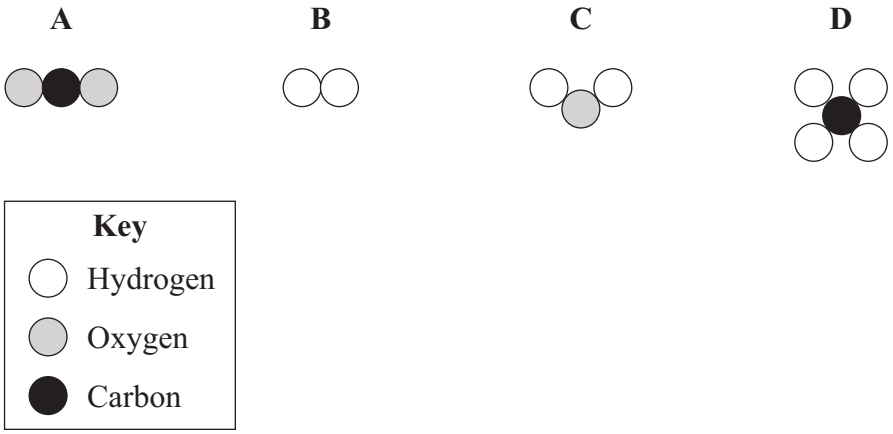
Copper wire is used in electrical circuits because it is . . . **3** . . . .

Pure gold is **not** normally used for jewellery because it is . . . **4** . . . .

Turn over for the next question

QUESTION FIVE

The diagrams show the numbers and different types of atoms in four substances, **A**, **B**, **C** and **D**.



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

	Formula for the substance
1	CO_2
2	H_2
3	H_2O
4	CH_4

QUESTION SIX

This question is about hydrocarbons and fuels.

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

A C_2H_5OH

B C_3H_8

C C_2H_4

D S

1	a hydrocarbon that is **not** an alkane
2	an alkane
3	a compound that is **not** a hydrocarbon
4	an element that may be found in a fuel

Turn over for the next question

SECTION TWO

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

Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SEVEN

In several parts of Britain, there are large limestone quarries in areas that otherwise are very attractive.

7A Why are these large limestone quarries necessary?

1 They create rock ledges on which birds can nest.

2 They provide areas for rock-climbing.

3 There is a huge demand for limestone for building.

4 Farmers spread a lot of limestone on their fields.

7B People who live near the quarries may benefit because . . .

1 they are able to buy cheap limestone.

2 they have a new recreational area.

3 more wildlife is attracted to the area.

4 there are more jobs in the area.

In one area, a new quarry is to be developed.

Local people are concerned because lorries from the quarry will drive down the village main street to reach the motorway.

The local people are to organise a petition for a village by-pass.

To support their petition, they plan to survey lorry numbers before and after the quarry opens.

7C Which of these suggestions from local people do you think will provide the best evidence to support their petition?

1 count the number of lorries filling up at the local petrol station

2 count the number of lorries joining the motorway near the village

3 count the number of lorries passing down the village main street

4 count the number of lorries parked at the village transport café

7D The residents should continue their survey until the quarry is fully working.

They should count the lorries . . .

1 at different times during the day.

2 only during daylight hours.

3 at the same times, day and night.

4 only during blasting times at the quarry.

Turn over for the next question

QUESTION EIGHT

- Iron is obtained by reducing its oxide ore with carbon.
- Aluminium **cannot** be obtained by reducing its oxide ore with carbon.
- Gold occurs as the metal itself.

8A From the information above, which row in the table shows the order of reactivity of the four elements?

	most reactive →			**least reactive**
1	aluminium	carbon	iron	gold
2	iron	aluminium	carbon	gold
3	iron	aluminium	gold	carbon
4	aluminium	iron	gold	carbon

8B Iron obtained directly from the blast furnace was used to build the Iron Bridge in Shropshire.

This bridge is unsuitable for use by modern lorries because . . .

1 it **cannot** be stopped from rusting.

2 it will easily bend out of shape.

3 it is too heavy to support its own weight.

4 it is too brittle and so it will break.

- Aluminium waste of high purity can be recycled.
- Any iron and other impurities are removed.
- The aluminium is then melted and processed in the same way as aluminium that has been extracted from its ore.
- Recycling aluminium in this way creates only 5% of the carbon dioxide produced by extracting aluminium from its ore.

8C Which of the following benefits an aluminium recycling company financially?

1 a fall in the price of aluminium

2 the high melting point of aluminium

3 the high purity of the aluminium waste arriving at the recycling plant

4 the metal can be purified by electrolysis

8D An environmental disadvantage of recycling aluminium is that . . .

1 the aluminium waste has to be transported for recycling.

2 land fill sites would **not** be filled so quickly.

3 the process creates only 5% of the carbon dioxide produced by extracting aluminium from its ore.

4 the price of aluminium will fall.

Turn over for the next question

QUESTION NINE

Scientists are researching new catalysts to convert compounds in coal into small hydrocarbon molecules.

These small molecules can be used to make liquid fuels such as petrol.

9A Scientists are trying to develop processes that convert coal into liquid fuels, such as petrol, because . . .

1 they have found new supplies of catalysts.

2 oil reserves are running out quickly.

3 there is no alternative to using coal.

4 catalysts are being used up.

9B Petrol is made from small molecules and **not** large molecules because hydrocarbons with small molecules . . .

1 have a higher boiling point.

2 are more viscous.

3 are darker in colour.

4 ignite more easily.

9C Both petrol and coal produce carbon dioxide when burned.

To compare the volume of the gas produced by a sample of coal with the volume of gas produced by a sample of petrol, a control variable would be . . .

1 how much carbon dioxide is produced.

2 the amount of coal and petrol used.

3 the speed at which each fuel is set alight.

4 the time taken to burn all the fuel.

9D Ethanol, made from plant material, is another liquid fuel used in cars.

Ethanol and petrol produce similar amounts of carbon dioxide when they burn.

Burning ethanol made from plant material, in cars, is thought to be less of an environmental problem than burning petrol.

This is because . . .

1 ethanol does **not** produce water when it burns.

2 using ethanol made from plants as a fuel does **not** change the amount of carbon dioxide in the atmosphere.

3 ethanol will burn without using oxygen.

4 in the car engine, only partial combustion of the ethanol occurs.

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 hydrocarbons and fuels.

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

A C_2H_5OH

B C_3H_8

C C_2H_4

D S

1	a hydrocarbon that is **not** an alkane
2	an alkane
3	a compound that is **not** a hydrocarbon
4	an element that may be found in a fuel

QUESTION TWO

The flow chart below gives information about some of the substances involved in the combustion of a hydrocarbon fuel.

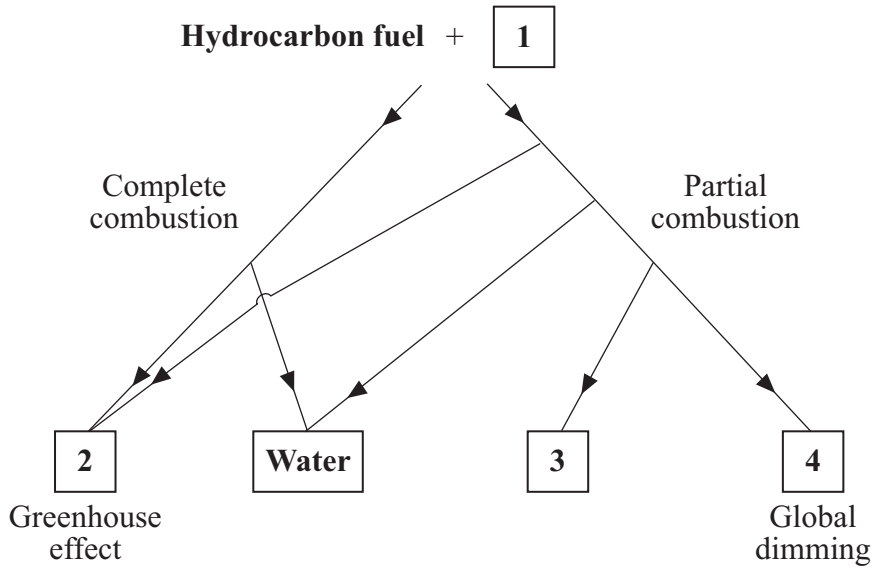
Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A carbon monoxide

B carbon particles

C oxygen

D carbon dioxide



Turn over for the next question

SECTION TWO

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

Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION THREE

- Iron is obtained by reducing its oxide ore with carbon.
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3	iron	aluminium	gold	carbon
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2 land fill sites would **not** be filled so quickly.

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4 the price of aluminium will fall.

Turn over for the next question

QUESTION FOUR

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These small molecules can be used to make liquid fuels such as petrol.

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4 in the car engine, only partial combustion of the ethanol occurs.

Turn over for the next question

QUESTION FIVE

Environmentalists say that the introduction of low-sulfur fuels is essential because it gives cleaner emissions from vehicles.

Scientists disagree about the emissions of carbon dioxide from low-sulfur fuels.
Some claim that low-sulfur fuels give higher emissions of carbon dioxide.
Other scientists suggest that the improved fuel consumption from these fuels means that less carbon dioxide is released.

5A Vehicle emissions would be cleaner using low-sulfur fuels because they would **definitely** produce less . . .

1 carbon dioxide.

2 carbon monoxide.

3 nitrogen oxides.

4 sulfur dioxide.

5B Scientists disagree about the emissions of carbon dioxide from low-sulfur fuels because . . .

1 they **cannot** repeat the results of their investigation.

2 simple experiments do **not** give accurate results.

3 there are **not** enough variables in their investigations.

4 the data they are using is too simple for a complex problem.

Oil companies are concerned about the cost of removing more sulfur from fuels. They claim that more dinitrogen oxide (N_2O) is produced by these fuels when catalytic converters are running at low temperatures. Dinitrogen oxide is 310 times more powerful than carbon dioxide as a greenhouse gas.

5C Oil companies do **not** want to remove more sulfur from fuels because . . .

1 increased production costs would put up the price of their fuels.

2 they would sell less fuel because of improved fuel consumption.

3 they do **not** agree that the emissions from low-sulfur fuels are cleaner.

4 customers do **not** believe that the fuels are any better for the environment.

5D The oil companies claim that more dinitrogen oxide is produced when low-sulfur fuels are used.

How could this be verified?

1 The oil companies should repeat their investigations.

2 Independent scientists should carry out further investigations.

3 Government scientists should measure the levels of dinitrogen oxide near motorways.

4 University students should research the effects of dinitrogen oxide when it is released into the atmosphere.

Turn over for the next question

QUESTION SIX

Crude oil contains a large number of alkanes, which have the general formula C_nH_{2n+2}

Crude oil can be separated into a number of fractions by fractional distillation.

6A Crude oil can be separated into fractions in this way because . . .

1 the alkanes it contains have different boiling points.

2 the alkanes it contains have different densities.

3 alkanes are compounds which are made up of more than one element.

4 all alkanes vaporise easily when they are heated.

6B Each fraction from the crude oil will contain . . .

1 a single alkane.

2 a mixture of several alkanes.

3 alkanes that have the same boiling point.

4 alkanes that have the same density.

The alkanes are a series of compounds.

The first ten alkanes in the series range from methane, CH_4 to decane, $C_{10}H_{22}$

6C The difference between the formulae of successive alkanes is . . .

1 C

2 H_2

3 CH

4 CH_2

6D Which of the following changes in the alkane series, from methane to decane?

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

Turn over for the next question

QUESTION SEVEN

Copper is found in the Earth's crust, both as the metal itself and as a variety of compounds.

7A This suggests that copper . . .

1 is a very reactive metal.

2 reacts with only a small number of other elements.

3 is **not** very reactive but more reactive than gold.

4 reacts rapidly with oxygen and sulfur at low temperatures.

A naturally occurring compound of copper is malachite, $CuCO_3.Cu(OH)_2$

7B Which row in the table shows the number of elements and the number of atoms of oxygen in the formula for malachite?

	Elements	**Atoms of oxygen**
1	4	5
2	4	4
3	5	3
4	6	2

Copper is extracted from high grade ores by first smelting the mined ore, then purification by electrolysis.

Copper salts can be extracted from some low grade ores by leaching. Sulfuric acid runs through the ore to produce a solution of copper sulfate. The copper can then be obtained from the solution by electrolysis.

7C An advantage of leaching over smelting is that . . .

1 leaching produces large amounts of copper sulfate.

2 there is no chance of environmental damage during leaching.

3 leaching does **not** require large quantities of energy.

4 there are no waste products left after leaching.

7D There is plenty of scrap copper and copper alloys that could be recycled.

One factor that could bring an increase in the amount that is recycled would be . . .

1 the opening of new large mines with high grade ores.

2 a reduction in the price of copper on the world markets.

3 that recycling became much more economic than extraction from the ore.

4 other metals being used instead of copper.

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 it in a traditional engine.

Hydrogen can be obtained from water by electrolysis. This method is both expensive and slow, so scientists are trying other methods.
A company has developed cells that can convert 8% of solar energy directly into hydrogen. They must reach an efficiency of 10% before the process becomes commercially viable.

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

1 oxygen only.

2 oxygen and carbon dioxide.

3 carbon dioxide only.

4 carbon dioxide and nitrogen.

8B One advantage that a hydrogen-powered vehicle has over a petrol-powered vehicle is that . . .

1 no sulfur dioxide is produced.

2 it causes only half the global dimming.

3 hydrogen-powered cars run on solar energy.

4 it is safer because 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 vehicles will only move during summer.

4 electrolysis is a slow process in the car.

A scientist has claimed that there are a number of technical and financial stumbling blocks. He said that the development of hydrogen-powered cars also required development of the cells 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 a hydrogen-powered car if hydrogen fuel is not widely available.

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

4 we must develop other fuels before oil runs out.

Turn over for the next question

QUESTION NINE

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END OF TEST