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

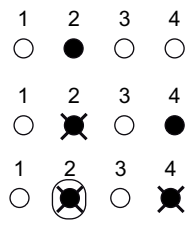
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.

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.

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

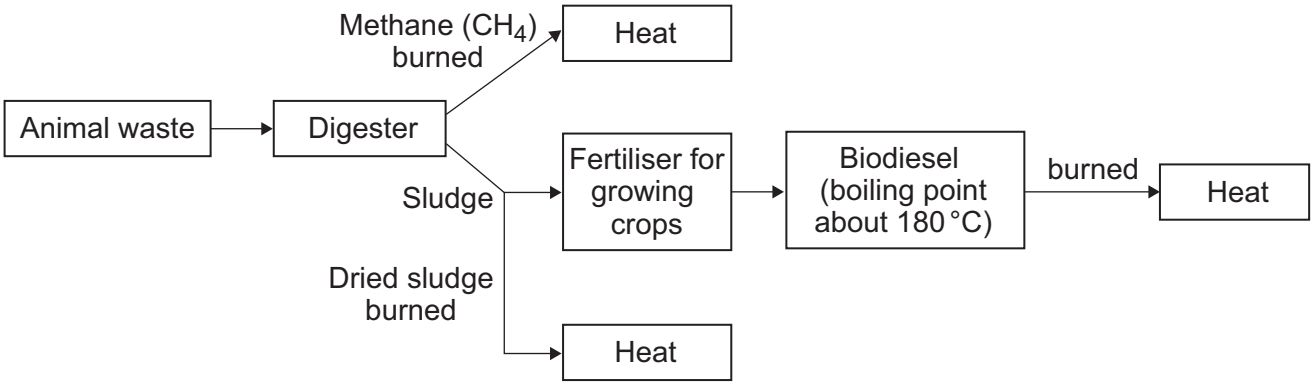
C will cause problems for the quarry owners

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.

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.

QUESTION FOUR

The substances that we get from the distillation of crude oil have a range of properties.

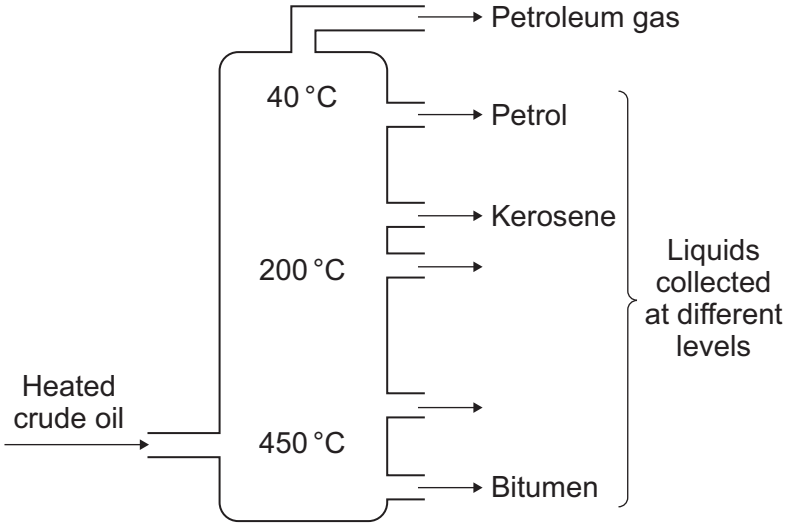
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

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.

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.

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

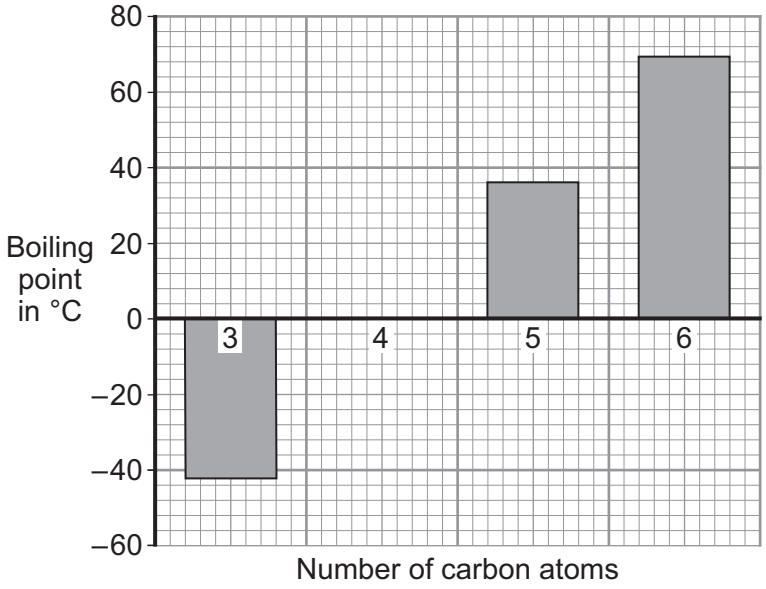
QUESTION SEVEN

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.

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.

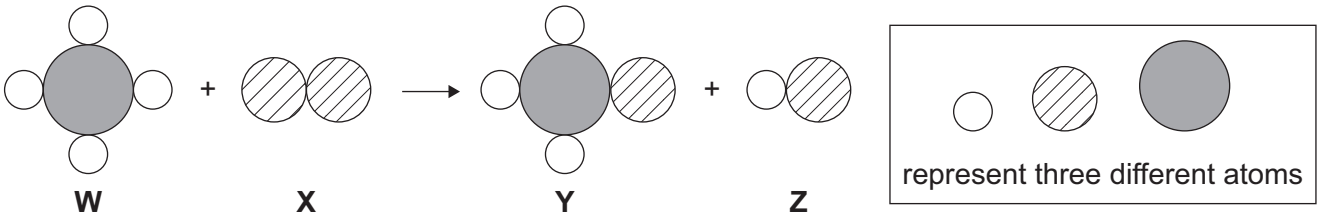
3 increases, the boiling point stays the same.

4 decreases, the boiling point stays the same.

Turn over for the next question

QUESTION EIGHT

The diagram shows the reaction between substances **W** and **X** to produce two new substances **Y** and **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.

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

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

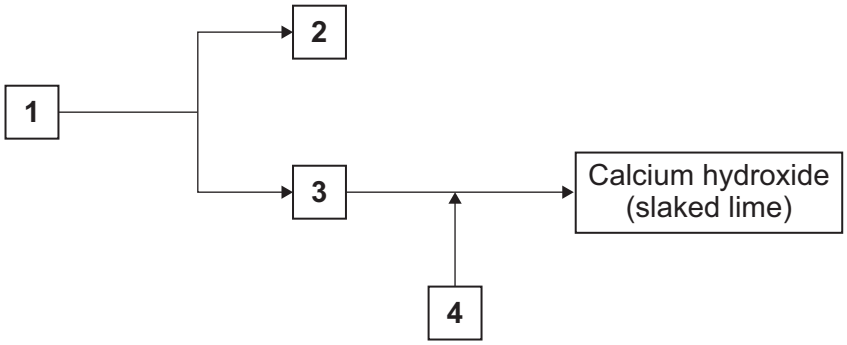
1	Aluminium is made when an electric current passes through a molten aluminium compound.
2	Gold can be found at the bottom of some streams.
3	Titanium is made by reacting titanium chloride with magnesium.
4	Zinc is made when a mixture of zinc oxide and carbon is heated.

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

Section Two

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

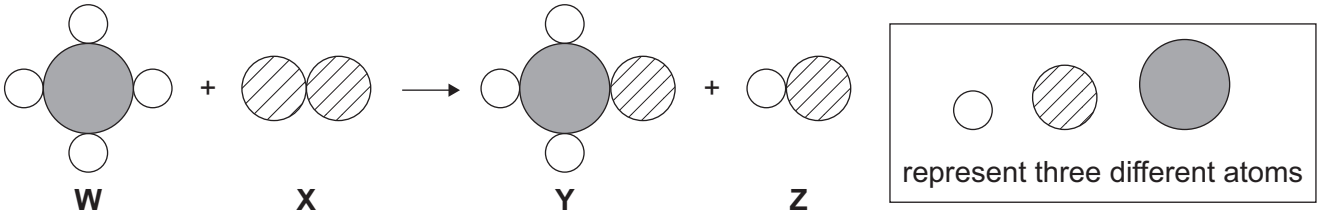
Each of these questions has four parts.

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.

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

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.

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

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

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 . . .

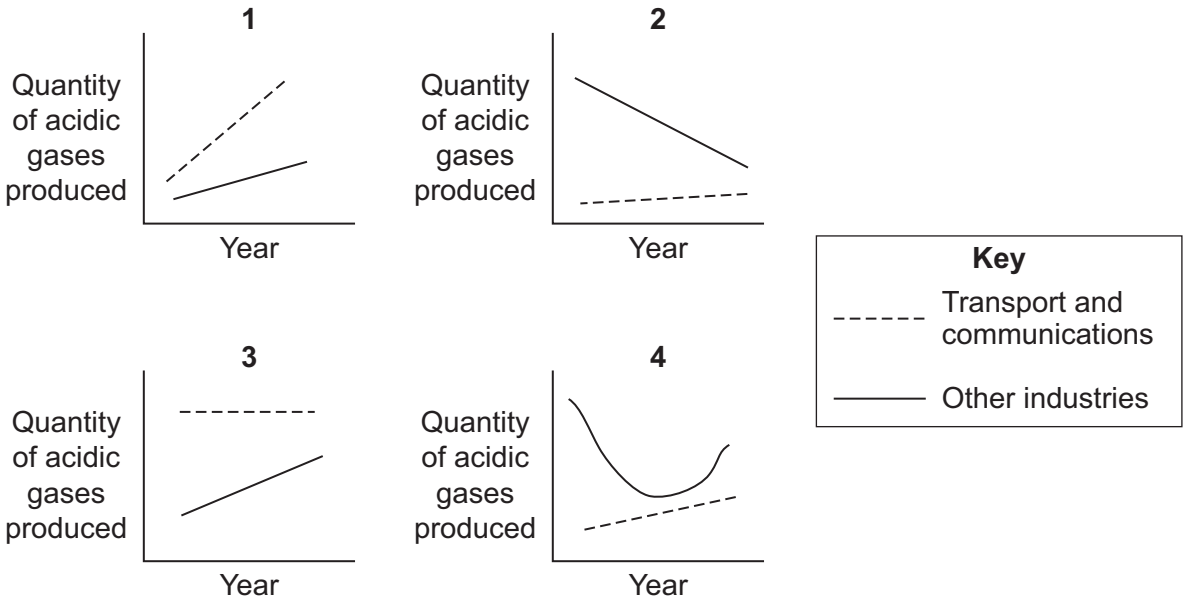
1 5%.

2 25%.

3 50%.

4 75%.

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 $4CO + 2NO_2 \rightarrow 4CO_2 + N_2$

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.

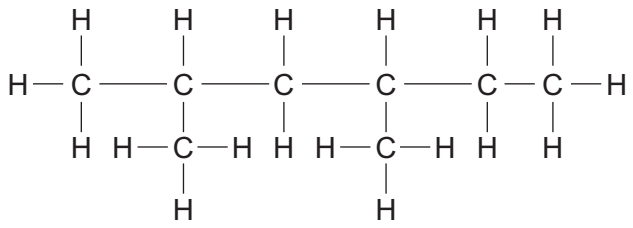
2 It will not use up the world's fuel supplies.

3 It will contribute to global warming.

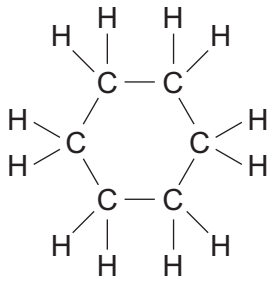
4 It is a continuous process that could go on for ever.

7C Which of the following hydrocarbons would give the same number of molecules of carbon dioxide on complete combustion as octane C_8H_{18}?

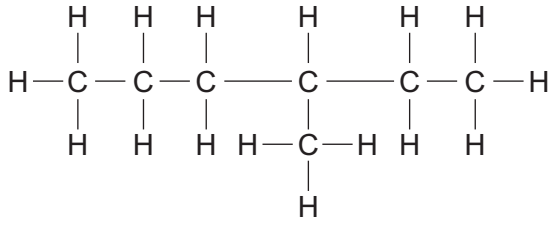
1



2



3



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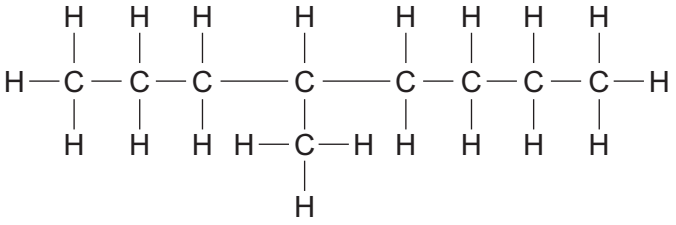


7D Hexane is the **sixth** member of the alkanes.

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

1 its chemical formula

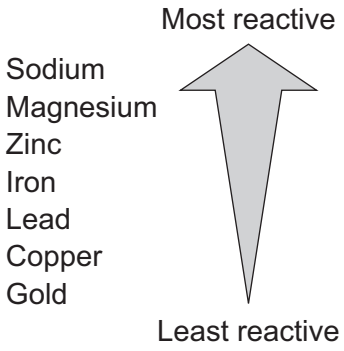
2 the number of water molecules produced by burning one molecule of hexane

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

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.

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

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 $CF_3CHCl–O–CHBrCHF_2$

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

There are no questions printed on this page