AQA GCSE CHEMISTRY (4421)

CHEMISTRY



EXAM QUESTION PACK

UNIT C1 HIGHER TIER CHY1H PAPERS

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Centre Number						Candidate Number				
Surname										
Other Names										
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For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2012

Science B
Unit Chemistry C1

Chemistry
Unit Chemistry C1

CHY1H

H

Written Paper

Friday 15 June 2012 1.30 pm to 2.15 pm

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice
- In all calculations, show clearly how you work out your answer.

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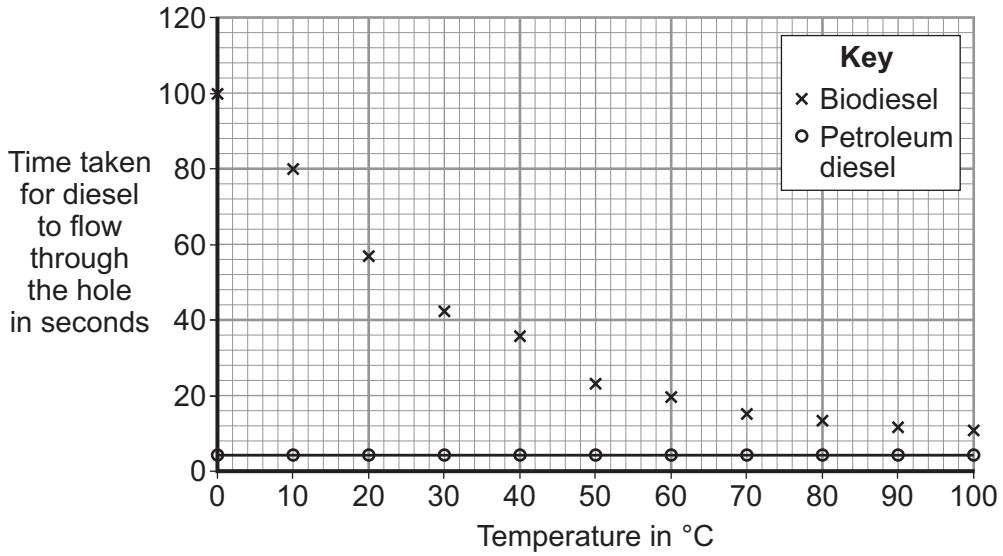
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ANSWER IN THE SPACES PROVIDED

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1 There are two main types of diesel fuel used for cars:

- biodiesel, made from vegetable oils
- petroleum diesel, made from crude oil.

1 (a) A scientist compared the viscosity of biodiesel with petroleum diesel at different temperatures.
The scientist measured the time for the same volume of diesel to flow through a small hole in a cup.
The scientist's results are plotted on the grid.



1 (a) (i) Draw a line of best fit for the biodiesel results.

(1 mark)

1 (a) (ii) What conclusions can the scientist make about the viscosity of biodiesel compared with the viscosity of petroleum diesel at different temperatures?

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(2 marks)

1 (a) (iii) Biodiesel may be less suitable than petroleum diesel as a fuel for cars.
Use these results to suggest **one** reason why.

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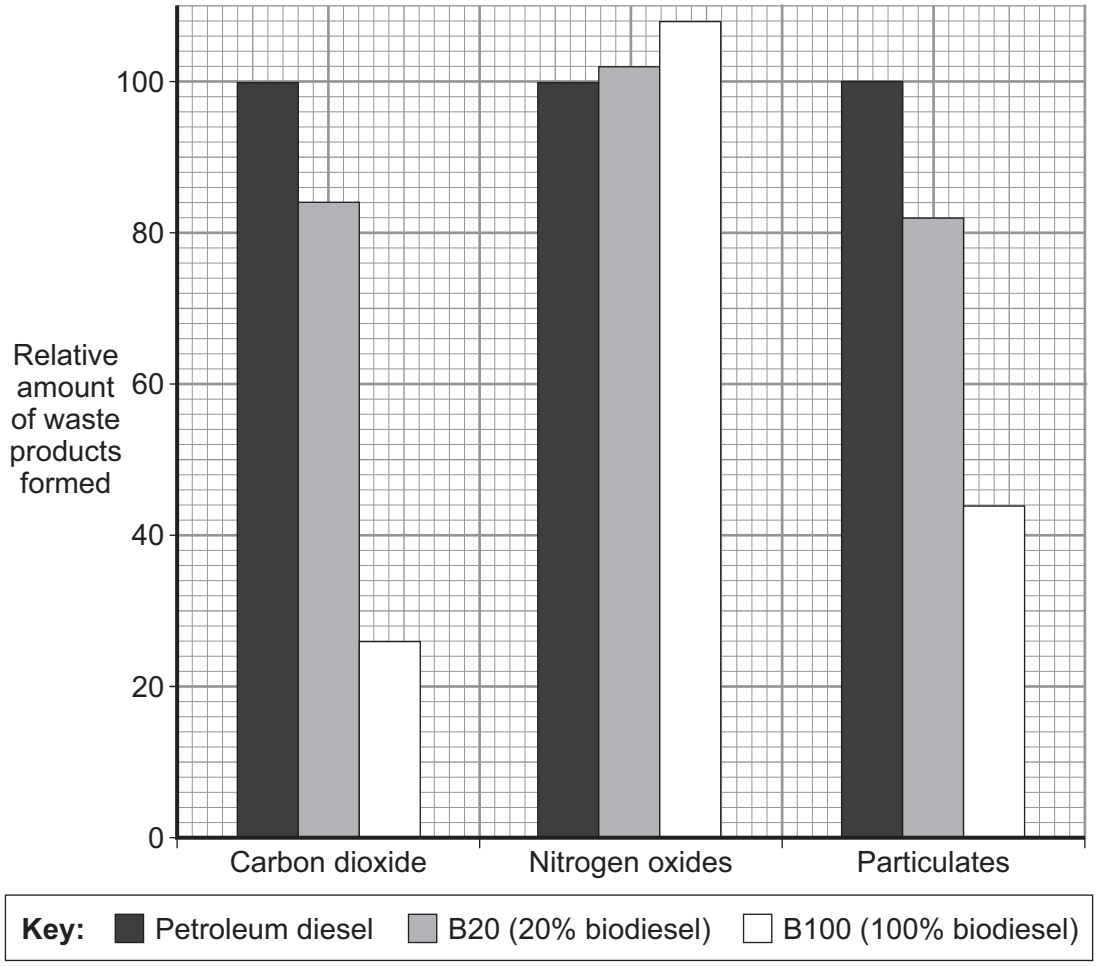
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(1 mark)

Turn over ▶

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1 (b) Biodiesel can be mixed with petroleum diesel to make a fuel for cars.
In a car engine, the diesel fuel burns in air.
The waste products leave the car engine through the car exhaust system.
The bar chart compares the relative amounts of waste products made when three different types of diesel fuel burn in a car engine.



Nitrogen oxides and sulfur dioxide cause a similar environmental impact.

1 (b) (i) What environmental impact do particulates from car exhaust systems cause?

.....

(1 mark)

1 (b) (ii) What is the percentage reduction in particulates when using B100 instead of petroleum diesel?

..... %

(1 mark)

Do not write outside the box

1 (b) (iii) Replacing petroleum diesel with biodiesel increases one type of environmental pollution.

Use the bar chart and the information given to explain why.

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(2 marks)

1 (b) (iv) A carbon neutral fuel does **not** add extra carbon dioxide to the atmosphere.

Is biodiesel a carbon neutral fuel?

Use the bar chart and your knowledge to explain your answer.

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(2 marks)

10

Turn over for the next question

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2 Read the article.

Problem food colourings

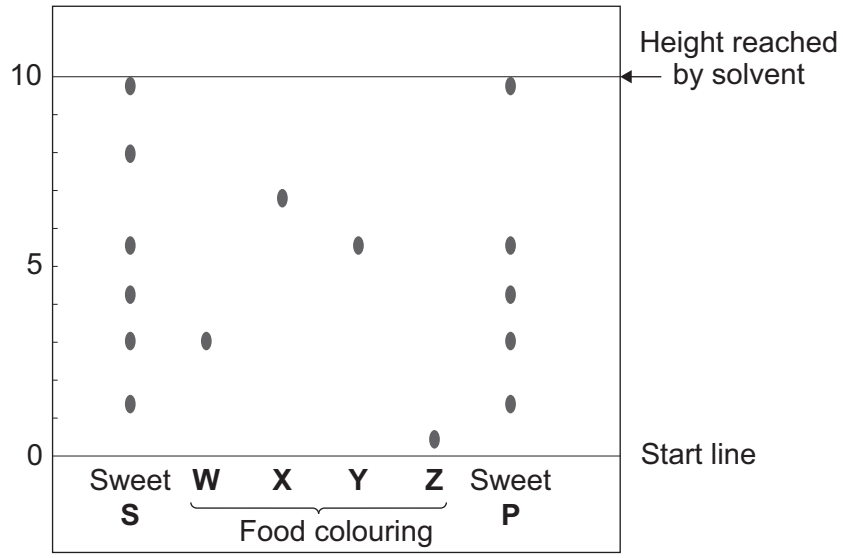
Scientists say they have evidence that some food colourings cause hyperactive behaviour in young children.

These food colourings are added to some sweets.

W, **X**, **Y** and **Z** are food colourings that may cause hyperactive behaviour in young children.

A scientist used chromatography to see if these food colourings were used in two sweets, **S** and **P**.

The results are shown on the chromatogram.



Do not write outside the box

2 (a) Food colourings, such as **W**, **X**, **Y** and **Z**, are added to some sweets.

Suggest **one** reason why.

.....

.....

(1 mark)

2 (b) In chromatography, the R_f value = $\frac{\text{distance moved by the colouring}}{\text{distance moved by the solvent}}$

Use the scale on the chromatogram to help you to answer this question.

Which food colouring, **W**, **X**, **Y** or **Z**, has an R_f value of 0.7?

(1 mark)

2 (c) From the chromatogram, what conclusions can the scientist make about the colourings in sweets **S** and **P**?

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(3 marks)

5

Turn over for the next question

Do not write outside the box

3 Steels are used to make cars, bridges and knives.
The main element in steel is iron.

3 (a) Iron is extracted from an *ore* that contains about 60% iron oxide, Fe_2O_3

3 (a) (i) What is the meaning of *ore*?

.....

.....

(1 mark)

3 (a) (ii) In a blast furnace, iron oxide reacts with carbon monoxide to produce iron.
The word equation for this reaction is:

iron oxide + carbon monoxide → iron + carbon dioxide

Complete and balance the chemical equation for this reaction.

Fe_2O_3 + ... CO → ..... + ...

(2 marks)

3 (a) (iii) Name the type of reaction that produces a metal from its metal oxide.

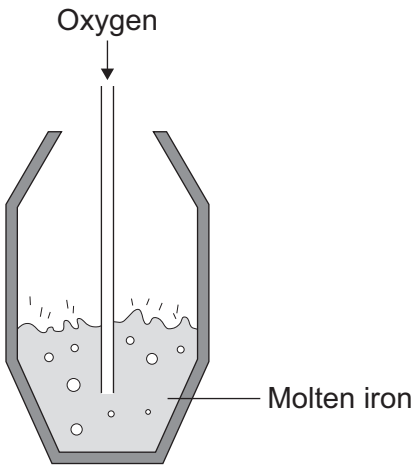
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(1 mark)

3 (b) Steels are produced from molten iron in two stages:

Stage 1 blowing oxygen into molten iron from the blast furnace.

Stage 2 adding other metals to make different steels.



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3 (b) (i) In **Stage 1**, suggest how the oxygen removes most of the carbon from the molten iron.

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(2 marks)

3 (b) (ii) **Stage 2** produces different steels.

Suggest why different steels are needed.

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(1 mark)

3 (c) Old 5p and 10p coins in the UK were made from cupro-nickel.
Cupro-nickel is 75% copper and 25% nickel.

New 5p and 10p coins in the UK are now made from nickel-plated steel and not from cupro-nickel.

Explain why.

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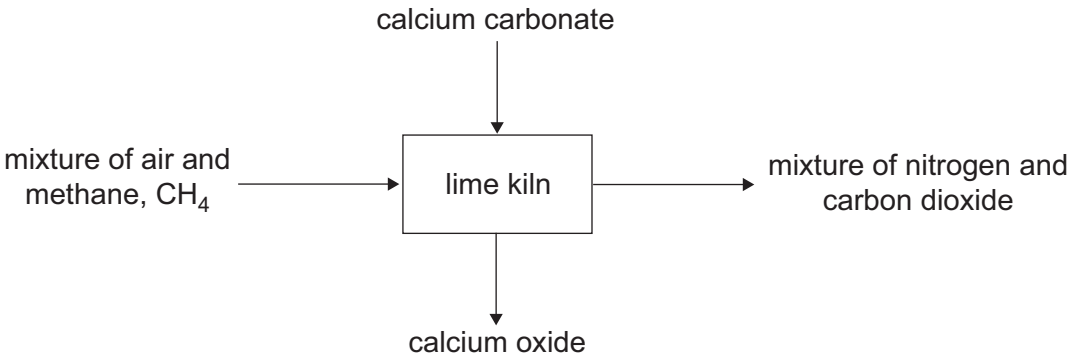
(2 marks)

9

Turn over for the next question

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4 Limestone is mainly calcium carbonate, $CaCO_3$
The flow diagram represents how calcium oxide (quicklime) is made when calcium carbonate (limestone) is heated in a lime kiln.



4 (a) (i) How many elements is calcium carbonate, $CaCO_3$, made from?

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(1 mark)

4 (a) (ii) The main gases leaving the lime kiln are nitrogen and carbon dioxide.

Explain why.

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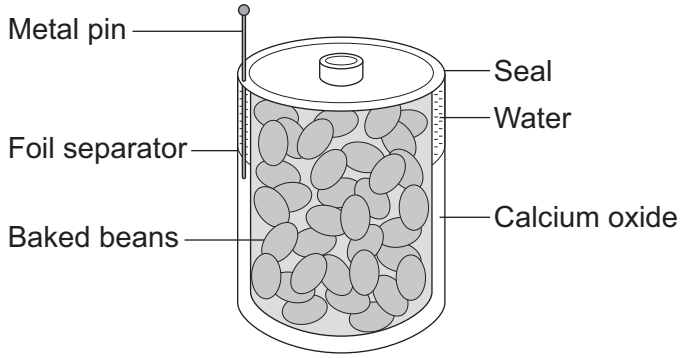
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(3 marks)

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4 (b) Calcium oxide (quicklime) is used in self-heating cans.

The diagram shows a self-heating can made to warm baked beans.



To warm the baked beans the metal pin is pushed through the seal and foil separator. The foil separator breaks allowing water to mix with the calcium oxide (quicklime).

Describe what happens when water mixes with calcium oxide.

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(2 marks)

6

Turn over for the next question

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5 There are different theories about how mountain ranges formed on the surface of the Earth.

5 (a) (i) Suggest **one** reason why there are different theories.

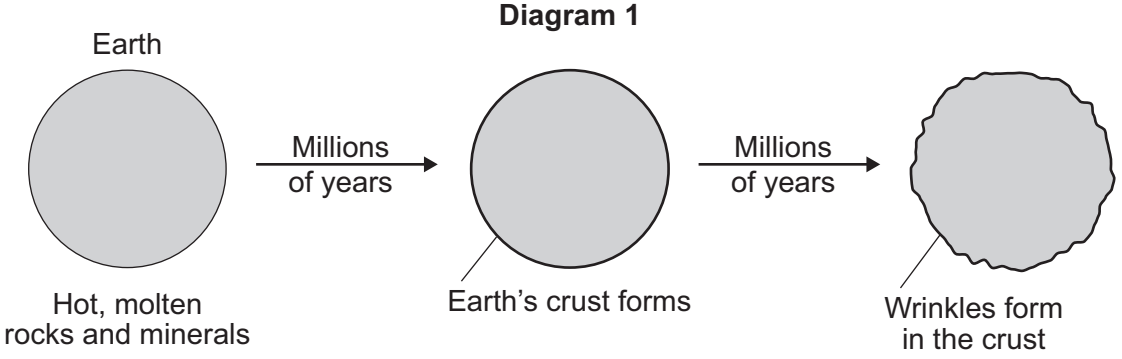
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(1 mark)

5 (a) (ii) **Diagram 1** represents an early theory of how mountain ranges may have formed.

Diagram 1



Use **Diagram 1** to suggest how mountain ranges may have formed.

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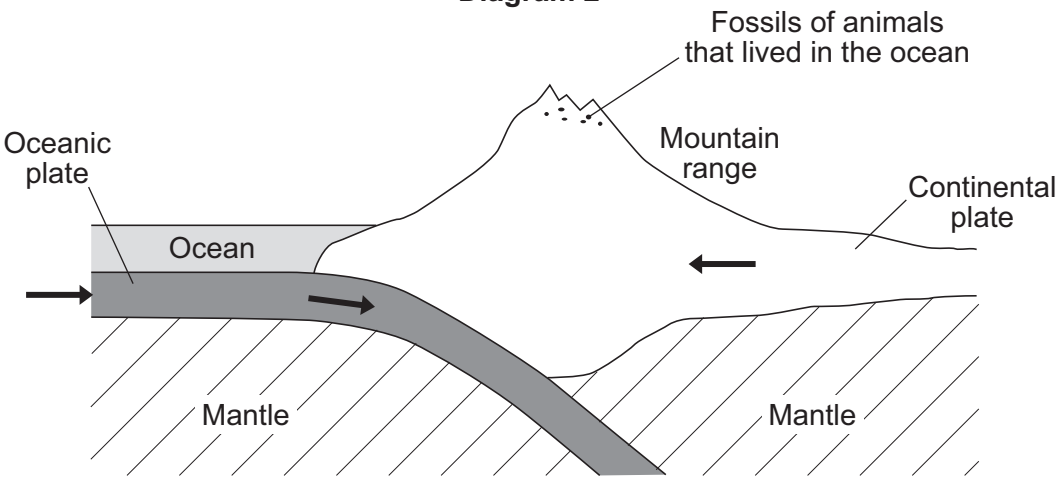
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(2 marks)

Do not write outside the box

5 (b) **Diagram 2** represents a more recent theory of how mountain ranges may have formed.

Diagram 2



5 (b) (i) The Earth's crust and the upper part of the mantle are cracked into a number of very large pieces called tectonic plates.

Explain how these tectonic plates are able to move.

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(3 marks)

5 (b) (ii) Use **Diagram 2** to suggest how mountain ranges may have formed.

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(2 marks)

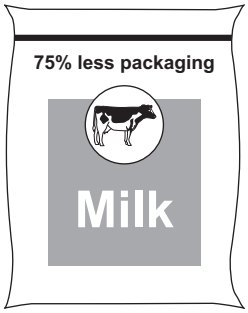
8

Turn over ▶

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6 Read the article and then answer the questions.

Supermarkets launch eco-friendly plastic milk bags. Could this be the end of the milk bottle?



Milk bottles are made from glass or from plastic.

Glass milk bottles contain 0.5 litres of milk. When the milk is used up the empty bottles are returned to be re-used. Glass milk bottles are re-used 24 times on average. The glass to make new milk bottles is produced when a mixture of sand, limestone, soda and recycled glass is heated to about 1600 °C in a furnace. There are almost unlimited amounts of the raw materials needed to produce this glass. About 35% of used glass is recycled.

The most common plastic milk bottles contain 2 litres of milk. When the milk is used up the empty bottles are discarded as waste. The plastic used to make these milk bottles is poly(ethene). Poly(ethene) is produced from crude oil by first using fractional distillation, then cracking the naphtha fraction and finally polymerising the ethene. About 5% of used poly(ethene) is recycled.

The new plastic milk bags contain 2 litres of milk. The milk bags are also made from poly(ethene). A milk bag uses 75% less poly(ethene) than is used to make the poly(ethene) milk bottles. When the milk is used up the empty bags are discarded as waste.

6 (a) Describe what happens in fractional distillation so that fractions, such as naphtha, are separated from crude oil.

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(3 marks)

Do not write outside the box

6 (b) Supermarkets claim that using milk bags instead of milk bottles would have less environmental impact.

Do you agree with this claim?

Use the information on page 14 and your knowledge and understanding to make appropriate comparisons to justify your answer.

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(4 marks)

7

END OF QUESTIONS

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Version : 15/08/2012

General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit Chemistry 1

Mark Scheme

2012 examination – June series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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Question 1

question	answers	extra information	mark
1(a)(i)	a reasonable attempt at a smooth curve	allow a curve which is close to but does not necessarily touch all points	1
1(a)(ii)	any **two** from: • biodiesel is more viscous than petroleum diesel at all / lower temperatures • biodiesel – as the temperature increases the viscosity decreases or vice versa • petroleum diesel – the viscosity does not change	allow thicker / thinner / runny for viscous if no other mark awarded allow **1** mark for any correct conclusion based on time or rate of flow	2
1(a)(iii)	does not flow as easily (through pipes / engine) **or** needs a high temperature to flow	allow could form a solid / block pipes / engine at low temperatures allow more difficult to vaporise / ignite ignore burning ignore references to viscosity	1
1(b)(i)	global dimming	allow correct description	1
1(b)(ii)	56 (%)		1

Question 1 continues on the next page . . .

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CHY1H

Question 1 cont'd….

question	answers	extra information	mark
1(b)(iii)	(increases) acid rain		1
	because there is more nitrogen oxide(s)	ignore sulfur dioxide if no other mark awarded allow **1** mark for nitrogen oxide(s) given	1
1(b)(iv)		answer yes or no does not gain credit because the marks are for an explanation ignore references to petroleum diesel allow carbon for carbon dioxide	
	no because carbon dioxide (26%) is released / produced		1
	this will not all be absorbed by photosynthesis / growing plants for biodiesel	accept growing plants / farming uses machinery / fossil fuels releases carbon dioxide	1
	OR yes because although carbon dioxide (26%) is released / produced (1)		
	this was absorbed by photosynthesis / growing plants(for biodiesel) (1)	allow this will be absorbed by photosynthesis / growing plants for biodiesel	
Total			**10**

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CHY1H

Question 2

question	answers	extra information	mark
2(a)	(improve) appearance	allow add colour allow these food colourings have not been proven to cause hyperactive behaviour in young children do **not** accept taste / flavour / preservatives ignore reference to E-numbers	1
2(b)	X		1
2(c)	any **three** from: • S contains six / 6 colourings • P contains five / 5 colourings • both S and P contain the same five / 5 colourings • both contain W **and** Y • both sweets (may) cause hyperactivity • neither contain X **and** Z	if neither of first 2 bullet points given allow **1** mark for S contains more colours than P **or** converse ignore unsafe	3
Total			**5**

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CHY1H

Question 3

question	answers	extra information	mark
3(a)(i)	contains enough metal to make it economical to extract		1
3(a)(ii)	Fe (+) CO_2	formula of both products must be correct	1
	(Fe_2O_3) (+) ....3....(CO)	balancing correct	1
	→		
	.....2.....(Fe) (+) .....3...(CO_2)	allow correct balancing using Fe_2	
3(a)(iii)	reduction	accept redox	1
3(b)(i)	oxygen reacts with the carbon	allow carbon monoxide for carbon dioxide	1
	to produce carbon dioxide		1
	OR		
	carbon dioxide is produced (1) which escapes as a gas (1)		
3(b)(ii)	to give steels with different / particular properties or for different / particular uses	ignore to make different alloys	1
3(c)	copper is very expensive	accept the metal (iron / steel) costs less than copper ignore energy	1
	because copper ores are 'low grade' / running out	allow copper is rare ignore nickel	1
Total			**9**

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Question 4

question	answers	extra information	mark
4(a)(i)	3 / three		1
4(a)(ii)	nitrogen does not react	allow nitrogen is not used up in the reaction	1
	carbon dioxide is a product of methane / fuel burning / reacting with oxygen	accept oxygen in the air reacts with methane	1
	carbon dioxide is a product of calcium carbonate decomposing (to produce calcium oxide)	do **not** allow calcium carbonate reacts with oxygen	1
4(b)	any **two** from: • water and calcium oxide / quicklime <u>react</u> • to produce calcium hydroxide / slaked lime • energy / heat <u>released</u> / exothermic	ignore mix ignore gets hot/heats up correct word equation = **2** marks	2
Total			**6**

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Question 5

question	answers	extra information	mark
5(a)(i)	any **one** from: • insufficient evidence for any of the theories • mountain ranges formed millions of years ago • scientists do not know what happens below the Earth's crust • scientists cannot test any theory	 accept no proof accept no scientist is certain of what the Earth was like millions of years ago ignore different scientists have different theories ignore references to other theories	1
5(a)(ii)	the Earth cooled (and formed a crust) the Earth contracted / shrank (causing wrinkles in the crust)	ignore references to other theories	1 1
5(b)(i)	radioactive processes / decay release energy / heat (inside the Earth) forming convection currents in the mantle		1 1 1
5(b)(ii)	oceanic plate and the continental plate / two plates are moving towards each other the continental plate / land is pushed up	accept oceanic plate and the continental plate / two plates are colliding with each other allow subduction accept sediments are pushed up **or** seabed is pushed up	1 1
Total			**8**

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Question 6

question	answers	extra information	mark
6(a)		allow answers referring specifically to the naphtha fraction	
	crude oil is <u>evaporated/vaporised</u> (by heating)		1
	the vapours are <u>condensed</u> (by cooling)		1
	(fractions condense) / boil at different temperatures	allow fractions have different boiling points	1
6(b)	any **four** from:	answer yes or no does not gain credit ignore references to volume of milk held / number of bottles used / biodegradability / habitats / pollution / mining / dust each marking point must be a comparison	4
	milk bag points		
	• uses (75%) less **crude oil** to make (than a plastic milk bottle)	allow eg uses 75% less poly(ethene) which is made from crude oil	
	• uses less **energy** / fuel to make (than a plastic / glass milk bottle)		
	• produces less **carbon dioxide** to manufacture (than a plastic / glass milk bottle)	allow produces less greenhouse gases / causes less global warming allow produces less CO_2 on burning	
	• produces less **waste** (than a plastic / glass milk bottle)	allow takes up less landfill (space) allow an argued case for more waste eg milk bags are discarded / cannot be reused	

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	• less fuel used for **transport** than glass milk bottles • (produces waste because) milk bags are only used once whereas glass bottles can be **re-used** poly(ethene) points • uses a limited **raw material** / crude oil whereas the raw materials for glass are almost unlimited • **less** (5%) poly(ethene) is **recycled** (compared to glass (35%))	allow milk bags are discarded but glass bottles can be reused (24 / many times) allow glass bottles can be reused but milk bags can't allow (35%) glass is recycled or (5%) poly(ethene) (bottles) recycled BUT milk bags aren't / are discarded **or** recycled poly(ethene) is not used to make new bags whereas recycled glass is used to make new bottles	
Total			**7**

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Examiner's Initials	
Question	Mark
1	
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3	
4	
5	
TOTAL	

General Certificate of Secondary Education
Higher Tier
January 2012

Science B
Unit Chemistry C1

Chemistry
Unit Chemistry C1

CHY1H

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Written Paper

Thursday 26 January 2012 9.00 am to 9.45 am

You will need no other materials.
You may use a calculator.

Time allowed
- 45 minutes

Instructions
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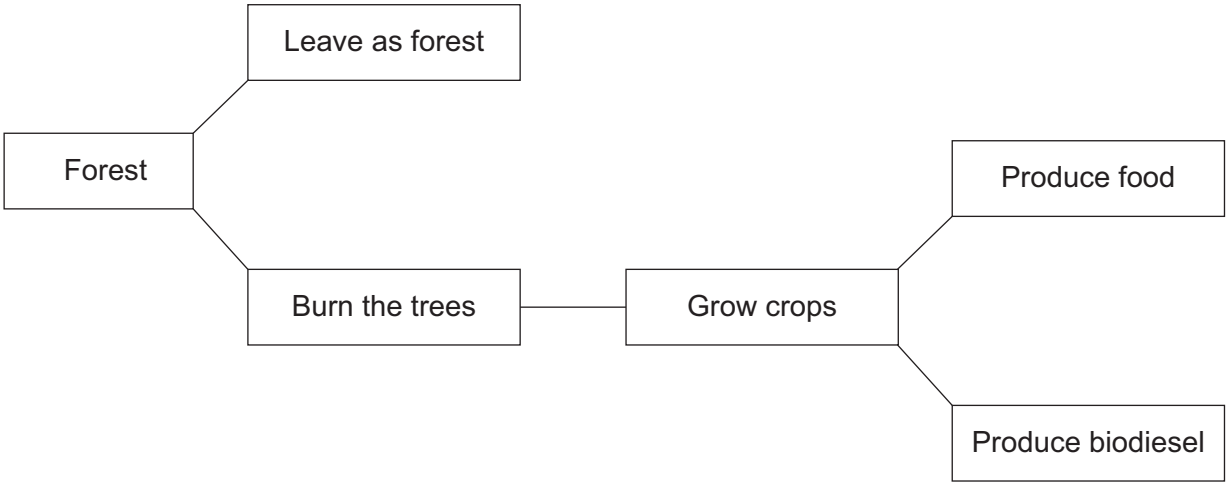
Advice
- In all calculations, show clearly how you work out your answer.

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Do not write outside the box

Answer **all** questions in the spaces provided.

1 Petroleum diesel is a fuel made from crude oil.
Biodiesel is a fuel made from vegetable oils.
To make biodiesel, large areas of land are needed to grow crops from which the vegetable oils are extracted.
Large areas of forest are cleared by burning the trees to provide more land for growing these crops.



1 (a) Use this information and your knowledge and understanding to answer these questions.

1 (a) (i) Carbon neutral means that there is no increase in the amount of carbon dioxide in the atmosphere.

Suggest why adverts claim that using biodiesel is carbon neutral.

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(2 marks)

Do not write outside the box

1 (a) (ii) Explain why clearing large areas of forest has an environmental impact on the atmosphere.

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(2 marks)

1 (b) Why is there an increasing demand for biodiesel?

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(1 mark)

1 (c) Suggest why producing biodiesel from crops:

1 (c) (i) causes ethical concerns

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(1 mark)

1 (c) (ii) causes economic concerns.

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(1 mark)

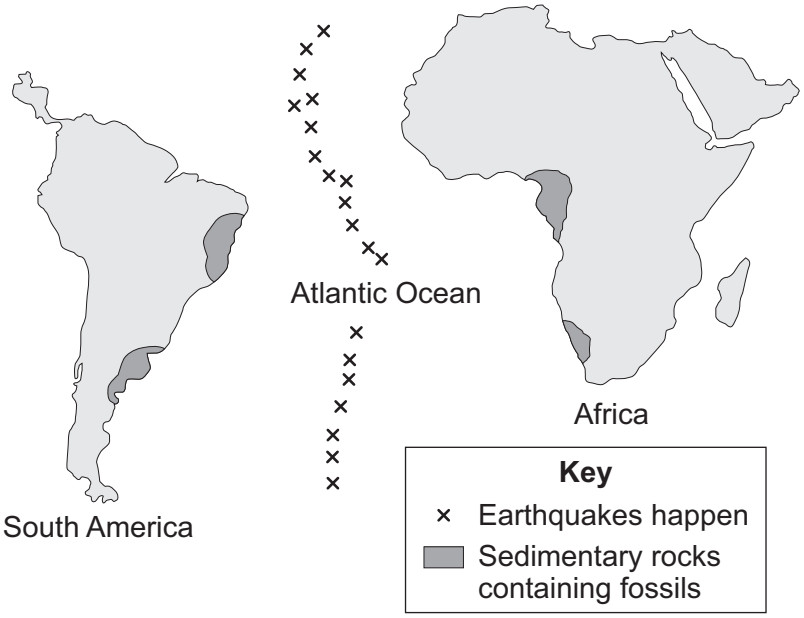
7

Turn over for the next question

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2 Earthquakes happen in some places on Earth.

The diagram shows some of these places that are between the continents of South America and Africa.



2 (a) (i) Why do earthquakes happen in the places shown on the diagram?

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(1 mark)

2 (a) (ii) Scientists cannot predict when earthquakes will happen.
Suggest why.

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(1 mark)

Do not write outside the box

2 (b) In 1915, Alfred Wegener proposed the idea of continental drift.
He suggested that South America and Africa had once been joined.
Most scientists in 1915 did not accept his idea.

2 (b) (i) In 1915, Wegener's idea was **not** accepted by most scientists.
Suggest **one** reason why.

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(1 mark)

2 (b) (ii) Use the information in the diagram to suggest **two** pieces of evidence that led to Wegener's idea being accepted by most scientists.

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(2 marks)

2 (c) Explain, in as much detail as you can, what is causing the continents of South America and Africa to move further apart.

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(3 marks)

8

Turn over ▶

Do not write outside the box

3 About 3000 million years ago, carbon dioxide was one of the main gases in the Earth's atmosphere.

About 400 million years ago, plants and trees grew on most of the land. When the plants and trees died they were covered by sand and slowly decayed to form coal.

3 (a) Describe and explain how the composition of the Earth's atmosphere was changed by the formation of coal.

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(3 marks)

3 (b) Today, coal is burned in power stations to release the energy needed by industry. Carbon dioxide, water and sulfur dioxide are produced when this coal is burned.

Name **three** elements that are in this coal.

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(2 marks)

Do not write outside the box

3 (c) In some power stations coal is mixed with calcium carbonate (limestone).
The mixture is crushed before it is burned.

3 (c) (i) Many chemical reactions happen when this mixture is burned.
The chemical equation represents one of these reactions.

Balance the chemical equation.

$2CaCO_3(s) + 2SO_2(g) + O_2(g) \rightarrow \ldots\ldots\ldots CaSO_4(s) + \ldots\ldots\ldots CO_2(g)$

(1 mark)

3 (c) (ii) Explain how the use of calcium carbonate in the mixture:

increases atmospheric pollution

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decreases atmospheric pollution.

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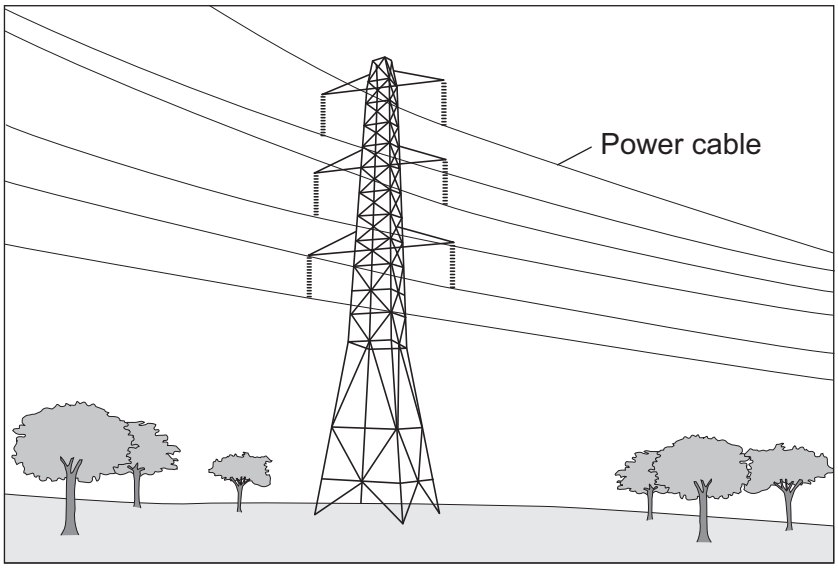
(4 marks)

10

Turn over for the next question

Do not write outside the box

4 Metals are used in the manufacture of overhead power cables.



The table shows some properties of three metals.

Metal	Density in g per cm^3	Melting point in °C	Percentage (%) relative electrical conductivity	Percentage (%) abundance in Earth's crust	Percentage (%) of metal in its ore
copper	8.92	1083	100	0.007	3
aluminium	2.70	660	60	8.1	25
iron	7.86	1535	20	5.0	60

4 (a) Use information from the table to explain why aluminium is used to conduct electricity in overhead power cables.

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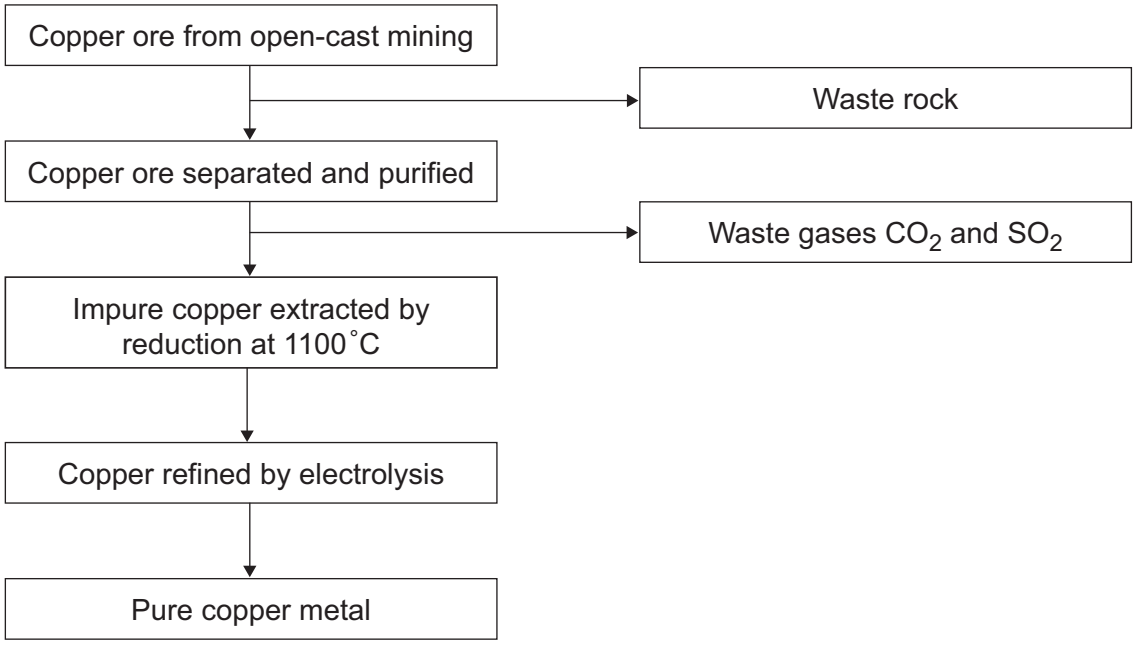
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(2 marks)

Do not write outside the box

4 (b) Most electric cables use copper to conduct electricity.
The main steps in the extraction of copper are shown in the flow diagram.



Use the information in the flow diagram and your knowledge and understanding to suggest the benefits of recycling copper compared with the extraction of copper from its ore.

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(3 marks)

Question 4 continues on the next page

Turn over ▶

Do not write outside the box

4 (c) PEX is a polymer that can be used to cover and insulate power cables.
PEX is made from poly(ethene).
Poly(ethene) is made from ethene.

4 (c) (i) Describe how ethene, C_2H_4, can be produced from pentane, C_5H_{12}

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(2 marks)

4 (c) (ii) The equation for the formation of poly(ethene) is shown.

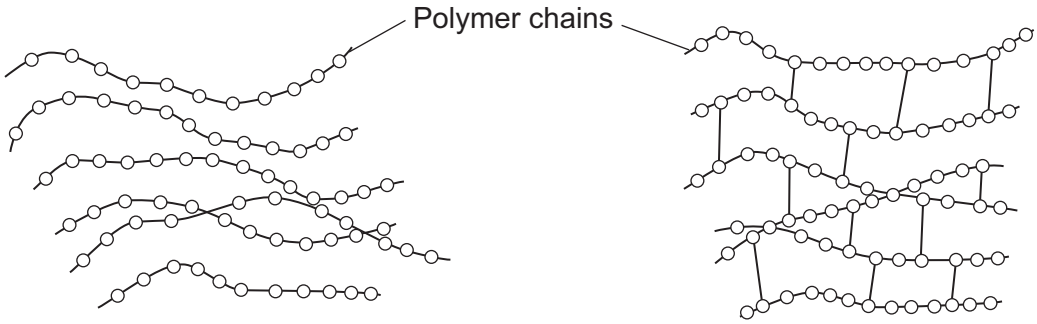
Complete the structure of poly(ethene) by drawing in the missing bonds of the product.



(1 mark)

Do not write outside the box

4 (c) (iii) The simplified structures of poly(ethene) and PEX are shown.



Poly(ethene) **PEX**

Poly(ethene) softens when heated and can be reshaped. PEX does not soften when heated and cannot be reshaped.

Use the structures to suggest and explain why.

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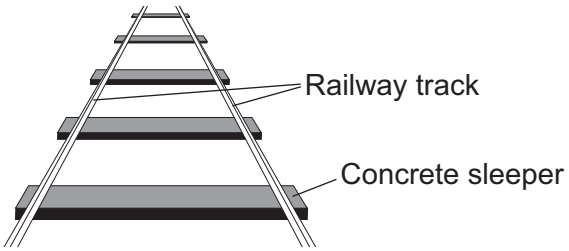
(3 marks)

11

Turn over for the next question

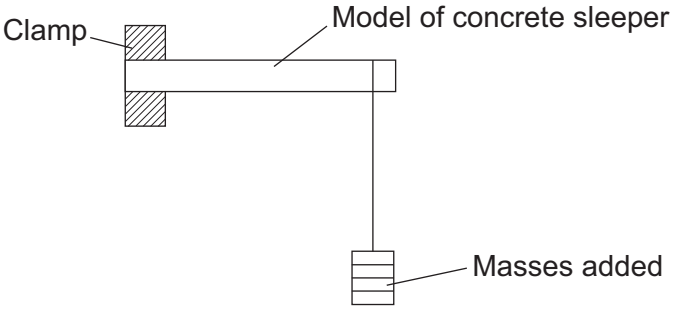
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5 In the UK railway sleepers were made from wood.
They are now often made from concrete.



A scientist was asked to find the best concrete mixture to use so that railway sleepers would not break easily. The scientist made:

- a mould to make small models of concrete sleepers
- concrete mixtures using crushed rock, sand, cement and water
- the equipment shown to add 0.1 kg masses until the model sleeper broke.



The scientist's results are shown in the table.

Concrete mixture in % by volume			Total mass added to break the model sleeper in kg				
Cement	**Sand**	**Crushed rock**	**Test 1**	**Test 2**	**Test 3**	**Test 4**	**Mean**
10	70	20	1.2	1.1	1.3	1.2	1.2
20	60	20	3.0	2.6	2.5	2.4	
30	50	20	3.5	3.3	3.3	3.3	3.3
40	40	20	3.9	3.8	4.0	3.3	3.9
50	30	20	4.2	4.5	4.2	4.3	4.3

5 (a) Calculate the mean total mass added to break the model sleeper that has 20% cement by volume.

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Mean = ... kg
(2 marks)

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5 (b) State **one** conclusion that the scientist could make from these results.

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(1 mark)

5 (c) The scientist sent the results in a report to a company that makes full-size concrete railway sleepers.

5 (c) (i) Suggest **two** other factors that the company should take into consideration before deciding which mixture to use to make a full-size concrete railway sleeper.

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(2 marks)

5 (c) (ii) The scientist's report claimed that using concrete sleepers instead of wooden sleepers would have less environmental impact.
Do you agree with the scientist's claim?
Use your knowledge and understanding to justify your answer.
Remember to compare using concrete with using wood for the sleepers.

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(4 marks)

9

END OF QUESTIONS

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Version : 07/03/2012

General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit Chemistry 1

Mark Scheme

2012 examination – January series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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Question 1

question	answers	extra information	mark
1(a)(i)		use of carbon throughout = **max 1**	
	burning biodiesel releases CO_2	ignore burning trees	1
	CO_2 is absorbed / used by the crops/plants (used to produce the biodiesel)	allow CO_2 absorbed / used by trees	1
1(a)(ii)		allow use of carbon for carbon dioxide throughout	
	increases CO_2 / greenhouse effect **OR** less CO_2 is absorbed (from atmosphere)	accept causes global warming allow causes climate change ignore other correct effects	1
	because burning trees releases CO_2 **OR** because there is less photosynthesis	accept fewer trees to absorb CO_2 **or** crops / plants do not absorb as much CO_2 as trees ignore habitats / biodiversity if no other mark awarded global dimming because of smoke / particles gains **1** mark	1
1(b)	any **one** from: • crude oil / fossil fuel is running out / non-renewable • demand for fuels / energy is increasing • new legislation / protocols	ignore carbon neutral / cost / less harmful / environmentally friendly allow biodiesel is renewable / sustainable ignore demand for biodiesel is increasing	1

Question 1continues on the next page…..

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Question 1 cont'd…

question	answers	extra information	mark
1(c)(i)	uses crops / land that could be used for food	allow destroys habitats **or** reduces biodiversity ignore cost	1
1(c)(ii)	increases the cost of food / land	ignore cost of machinery / process ignore cheaper to produce biodiesel	1
Total			**7**

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CHY1H

Question 2

question	answers	extra information	mark
2(a)(i)	plate boundary	allow plates moving / colliding allow fault line / sea floor spreading allow plate tectonics	1
2(a)(ii)	any **one** from: • do not know what happens below the Earth's crust • no pattern	 allow its underground allow random	1
2(b)(i)	any **one** from: • he could not explain how continents could move • other ideas existed (that continents were in fixed positions **or** there had been a land bridge)	 allow there was no evidence / no proof / did not know about plates allow it went against established ideas	1
2(b)(ii)	any **two** from: • similar fossils • similar rocks • jigsaw fit	accept in addition modern ideas such as sea floor spreading ignore plants / animals allow rocks match up allow reference to super continent / pangea	2
2(c)	(continents move) because there are convection currents in the mantle caused by radioactivity	 if no other mark awarded 'continents on different plates' gains **1** mark	1 1 1
Total			**8**

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Question 3

question	answers	extra information	mark
3(a)	carbon dioxide decreased (by plants / trees)	allow plants / trees absorbed carbon dioxide	1
	oxygen increased (by plants / trees)	allow plants / trees released oxygen if neither of these marks awarded allow plants / trees photosynthesise for **1** mark	1
	because coal 'locks up' / traps / stores carbon dioxide / carbon	allow trees 'locked up' carbon dioxide / carbon	1
3(b)	carbon / C hydrogen / H sulfur / S	all 3 correct **2** marks 1 or 2 correct **1** mark allow H_2 ignore oxygen	2
3(c)(i)	2 2	balancing must be correct do **not** accept changed formulae	1
3(c)(ii)	increases atmospheric pollution carbon dioxide / CO_2 released from the (thermal) decomposition of calcium carbonate **or** description of this decomposition **or** equation decreases atmospheric pollution sulfur dioxide / SO_2 is removed by reaction with calcium oxide **or** calcium carbonate	 accept causes global warming **or** CO_2 is a greenhouse gas ignore sulfur dioxide and effects in this part accept less acid rain produced accept neutralisation **or** forms calcium sulfate	 1 1 1 1
Total			**10**

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CHY1H

Question 4

question	answers	extra information	mark
4(a)	aluminium has low(est) density aluminium is a better conductor of electricity than iron	ignore light / lightweight accept it is a good conductor **or** any valid comparison with iron / copper ignore other **correct** statements treat **incorrect** statements as a list ignore cheaper / easier to extract	1 1
4(b)	any **three** from: Recycling compared to the extraction from the ore: • conserves copper ores / copper / resources • causes fewer environmental problems of mining / quarrying eg. dust / loss of habitat • produces less waste disposal / landfill • produces less atmospheric pollution (by CO_2 / SO_2) • uses less energy/fuel / electricity	accept converse arguments for extraction allow produces less global warming / greenhouse gases / acid rain / harmful gases ignore waste gases ignore cost / electrolysis	3

Question 4 continues on the next page . . .

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Question 4 continued . . .

question	answers	extra information	mark
4(c)(i)	heat (pentane) / high temperature catalyst / steam	stated temperature must be ≥ 200°C allow porous pot if no other mark obtained then award **1** mark for cracking alone wrong process = **0** marks	1 1
4(c)(ii)	all single bonds between C H and C C are correct	ignore changes to reactants	1
4(c)(iii)	any **three** from: <u>in PEX:</u> • cross links / extra bonds **or** chains joined together • so the chains are held in position <u>in poly(ethene)</u>: • no cross links / extra bonds **or** chains not joined together **or** weak intermolecular forces • so the chains can move / slide (over each other)	allow molecules / atoms / layers for chains throughout	3
Total			**11**

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Question 5

question	answers	extra information	mark
5(a)	2.5	correct answer with or without working gains **2** marks if answer incorrect 2.6 / 2.625 / 2.62 / 2.63 **or** recognise 3.0 as anomalous gains **1** mark accept answer in table ignore units	2
5(b)	as the percentage of cement increases the mass needed to break the sleeper increases **or** as the percentage of sand increases the mass needed to break the sleeper decreases	allow 50% cement is the strongest **or** 30% sand is the strongest **or** the highest amount of cement is the strongest	1
5(c)(i)	any **two** from: • availability of materials • cost (of materials) • time needed (for the concrete mixture) to set/harden • compression strength (of the concrete) • testing full size (concrete railway sleepers)	 accept weight of the train accept any test on full size sleepers accept 'how well it would last / weather'	2

Question 5 continues on the next page . . .

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Question 5 continued . . .

question	answers	extra information	mark
5(c)(ii)	any **four** from: <u>negative concrete:</u> • more fossil fuel / energy / heat (needed to produce cement / concrete) • cement / concrete resources / limestone not renewable whereas wood is renewable • quarrying limestone destroys landscapes / habitats whereas growing wood improves landscapes / habitats • making cement / concrete releases carbon dioxide / greenhouse gases whereas growing wood absorbs carbon dioxide / greenhouse gases / is carbon neutral <u>positive concrete:</u> • (less resources are needed because) cement / concrete sleepers last longer **or** wood rots / needs replacing	maximum of **3** marks if no comparison made ignore yes or no allow converse statements for wood allow quarrying causes noise pollution / dust / etc. allow making cement / concrete causes global warming / climate change whereas growing wood reduces global warming / climate change ignore loss of trees / deforestation (and resultant effects such as an increase in CO_2) ignore strength / ease of breaking ignore weathering / effects of acid rain	4
Total			**9**

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

AQA

General Certificate of Secondary Education
Higher Tier
June 2011

Science B
Unit Chemistry C1

CHY1H

H

Chemistry
Unit Chemistry C1

Wednesday 15 June 2011 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice
- In all calculations, show clearly how you work out your answer.

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Do not write outside the box

Answer **all** questions in the spaces provided.

1 Scientists state that unsaturated fats are healthier to eat than saturated fats.

The table shows some information about four fats.

	Fat content as a percentage (%)		
Fat	**Unsaturated**	**Saturated**	**Melting point in °C**
A	80	20	–11
B	60	40	–5
C	30	70	+4
D	10	90	+63

1 (a) (i) Which fat, **A**, **B**, **C** or **D**, has the lowest melting point?

(1 mark)

1 (a) (ii) Use the information in the table to describe the pattern between the percentage of unsaturated fat and the melting point.

.....

.....

(1 mark)

1 (a) (iii) Which fat, **A**, **B**, **C** or **D**, contains the smallest number of carbon carbon double bonds per gram?

(1 mark)

1 (b) Fat **A** is reacted with hydrogen (hydrogenated).

State **one** way in which the physical properties of Fat **A** are changed by this reaction.

.....

.....

(1 mark)

Do not write outside the box

1 (c) Tick (✓) **one** thing that scientists are **not** able to do.

One thing that scientists are not able to do	Tick (✓)
find out if a fat is unsaturated	
show that an unsaturated fat is healthier to eat than a saturated fat	
stop people eating unhealthy fat	
change unsaturated fat to saturated fat	

(1 mark)

5

Turn over for the next question

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2 The raw materials used to make the polymer polyvinyl chloride (PVC) are crude oil and sea salt (sodium chloride).

2 (a) There are three main stages in the production of PVC.

2 (a) (i) **Stage 1** Cracking of hydrocarbons from crude oil produces ethene, C_2H_4

$$C_{10}H_{22} \longrightarrow C_8H_{18} + C_2H_4$$

How are hydrocarbons cracked?

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(2 marks)

2 (a) (ii) **Stage 2** Electrolysis of sodium chloride solution produces chlorine.
Ethene from **Stage 1** is then reacted with this chlorine.
One of the hydrogen atoms in each ethene molecule is replaced by a chlorine atom to produce vinyl chloride.

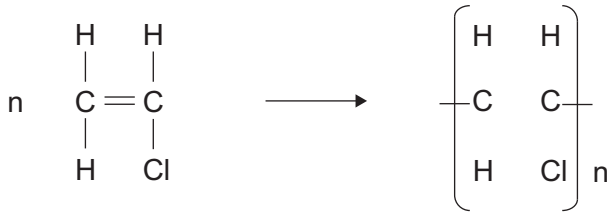
Complete the chemical equation by writing in the formula of the product vinyl chloride.

$$C_2H_4 + Cl_2 \longrightarrow \text{.....} + HCl$$

(1 mark)

2 (a) (iii) **Stage 3** Polymerisation of vinyl chloride produces polyvinyl chloride (PVC).

Complete the chemical equation by drawing in the missing bonds of the product, PVC.



Vinyl chloride PVC

(1 mark)

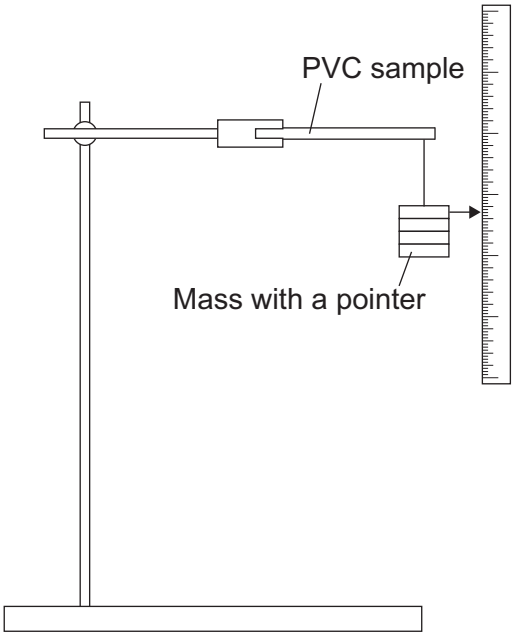
Question 2 continues on the next page

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2 (b) Unplasticised polyvinyl chloride (uPVC) is used to make door and window frames.
PVC with a plasticiser added is used to make cling film for wrapping food.
A plasticiser is a chemical compound.

A student investigated how the percentage of plasticiser added to PVC affected its flexibility.
The student measured the bending of PVC samples when a mass was added.



The student's results are shown in the table.

Sample of PVC	Percentage (%) of plasticiser added	Bending of PVC sample in mm				
		Test 1	Test 2	Test 3	Test 4	Mean
A	**0**	2	3	3	4	3
B	**5**	22	15	23	24	
C	**10**	27	27	29	29	28
D	**15**	34	35	35	36	35

2 (b) (i) Each PVC sample should be the same size to make it a fair test.
Explain why.

.....

.....

(1 mark)

Do not write outside the box

2 (b) (ii) The student repeated the test four times for each sample.
Explain why.

.....

.....

(1 mark)

2 (b) (iii) Calculate the mean value for sample **B**.

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(2 marks)

2 (b) (iv) Each of the samples bent the most in test **4**.
Suggest a possible reason for this.

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(1 mark)

2 (c) Suggest why unplasticised polyvinyl chloride (uPVC) is used to make door and window frames.

.....

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(1 mark)

10

Turn over for the next question

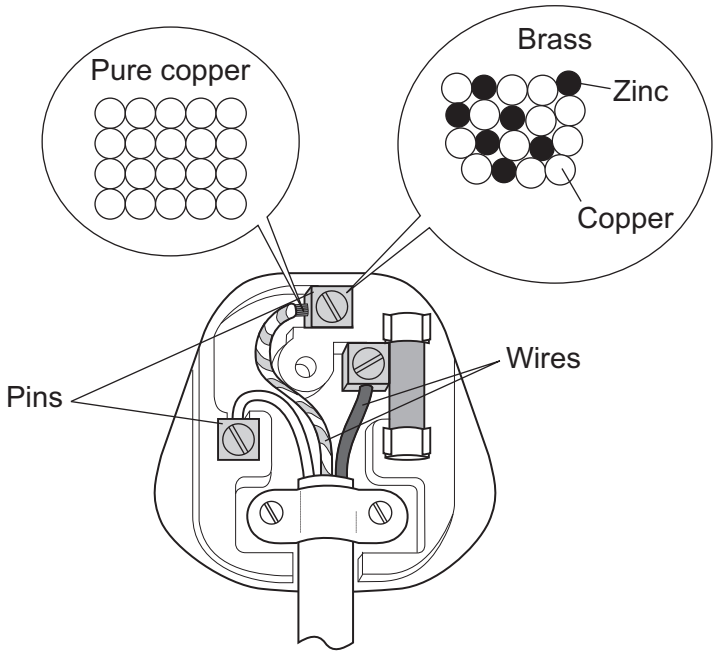
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3 The diagram shows an electric plug.



3 (a) Brass is used for the pins because it is harder than pure copper. Use the particle diagrams to help you to explain why.

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(2 marks)

Question 3 continues on the next page

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3 (b) An ore contains a mixture of zinc carbonate and lead carbonate. Zinc and lead are produced from this ore by two reactions.

3 (b) (i) **Reaction 1**: The carbonates in the ore are converted into a mixture of zinc oxide and lead oxide.

Name this type of reaction. .....

How is this reaction done? .....

.....

(2 marks)

3 (b) (ii) **Reaction 2**: The metal oxides are mixed with carbon and heated in a furnace to produce zinc and lead.

Explain why zinc and lead are produced.

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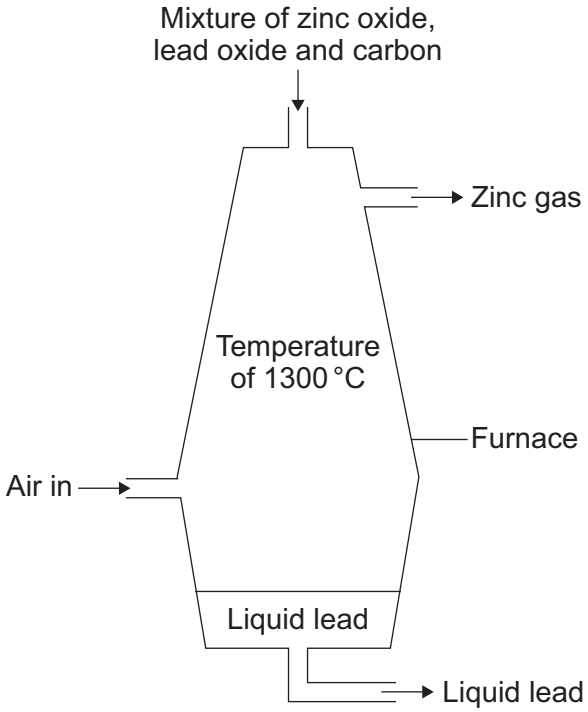
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(2 marks)

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3 (b) (iii) The diagram represents a furnace used to produce zinc and lead from their oxides.



Metal	Melting point in °C	Boiling point in °C	Density in g per cm^3
Lead	328	1751	11.3
Zinc	420	908	7.1

Use the diagram and the information in the table to explain how zinc and lead are separated in the furnace.

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(2 marks)

8

Turn over for the next question

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4 This is part of an article about food additives.

THE PERIL OF FOOD ADDITIVES

Some orange drinks contain the additives E102 (Tartrazine), E104 (Quinoline Yellow) and E110 (Sunset Yellow).
These three additives are thought to cause hyperactivity in children.

4 (a) State **two** reasons why a manufacturer could justify the use of these additives.

1 .....

.....

2 .....

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(2 marks)

4 (b) Some scientists asked 4000 twelve year-old children to help them to investigate if there is a link between these three additives and hyperactivity.
How would the scientists use these 4000 children to investigate if there is a link between these three additives and hyperactivity in children?

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(4 marks)

Do not write outside the box

4 (c) A manufacturer used an independent scientist to show that their orange drink did not contain these three additives.

4 (c) (i) Suggest why the manufacturer would use a scientist who was independent instead of using their own scientist.

.....

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(1 mark)

4 (c) (ii) The scientist had samples of E102, E104 and E110 and the orange drink. The scientist used paper chromatography for the test.

Describe how the scientist could use the results to show that the orange drink did not contain any of these three additives. (You may include a diagram of the paper chromatography results.)

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(2 marks)

9

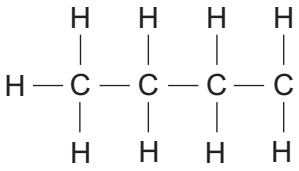
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5 Crude oil is a mixture of hydrocarbons. Most of these hydrocarbons are alkanes.

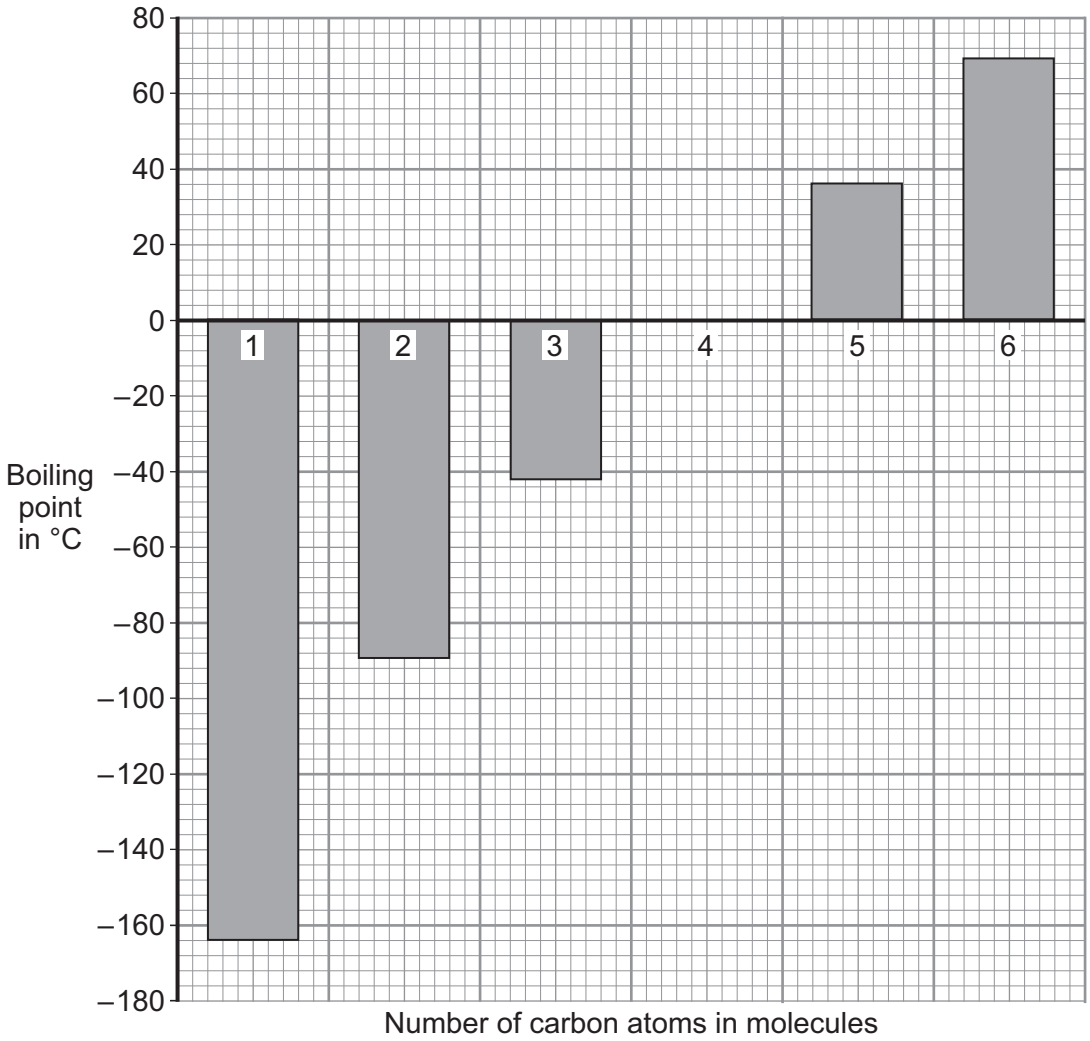
5 (a) The general formula of an alkane is C_nH_{2n+2}

Complete the structural formula for the alkane that has **six** carbon atoms in its molecules.



(1 mark)

5 (b) The boiling points of alkanes are linked to the number of carbon atoms in their molecules.



5 (b) (i) Describe the link between the number of carbon atoms in an alkane molecule and its boiling point.

.....

.....

(1 mark)

Do not write outside the box

5 (b) (ii) Suggest **two** reasons why all of the alkanes in the bar chart are better fuels than the alkane with the formula $C_{30}H_{62}$

1 .....

.....

2 .....

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(2 marks)

5 (c) During the last 200 million years the carbon cycle has maintained the percentage of carbon dioxide in the atmosphere at about 0.03 %.
Over the last 100 years the percentage of carbon dioxide in the atmosphere has increased to about 0.04 %.
Most of this increase is caused by burning fossil fuels to heat buildings, to generate electricity and to power our transport.
Fossil fuels contain carbon that has been locked up for millions of years.

5 (c) (i) Burning fossil fuels, such as petrol, releases this locked up carbon. Balance the chemical equation for the combustion of one of the alkanes in petrol.

$$2\,C_8H_{18} + 25\,O_2 \longrightarrow \text{.....}\ CO_2 + \text{.....}\ H_2O$$

(1 mark)

5 (c) (ii) Where did the carbon that is locked up in fossil fuels come from?

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(1 mark)

5 (c) (iii) The burning of fossil fuels has caused the percentage of carbon dioxide in the atmosphere to increase to above 0.03 %.
Explain why.

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(2 marks)

8

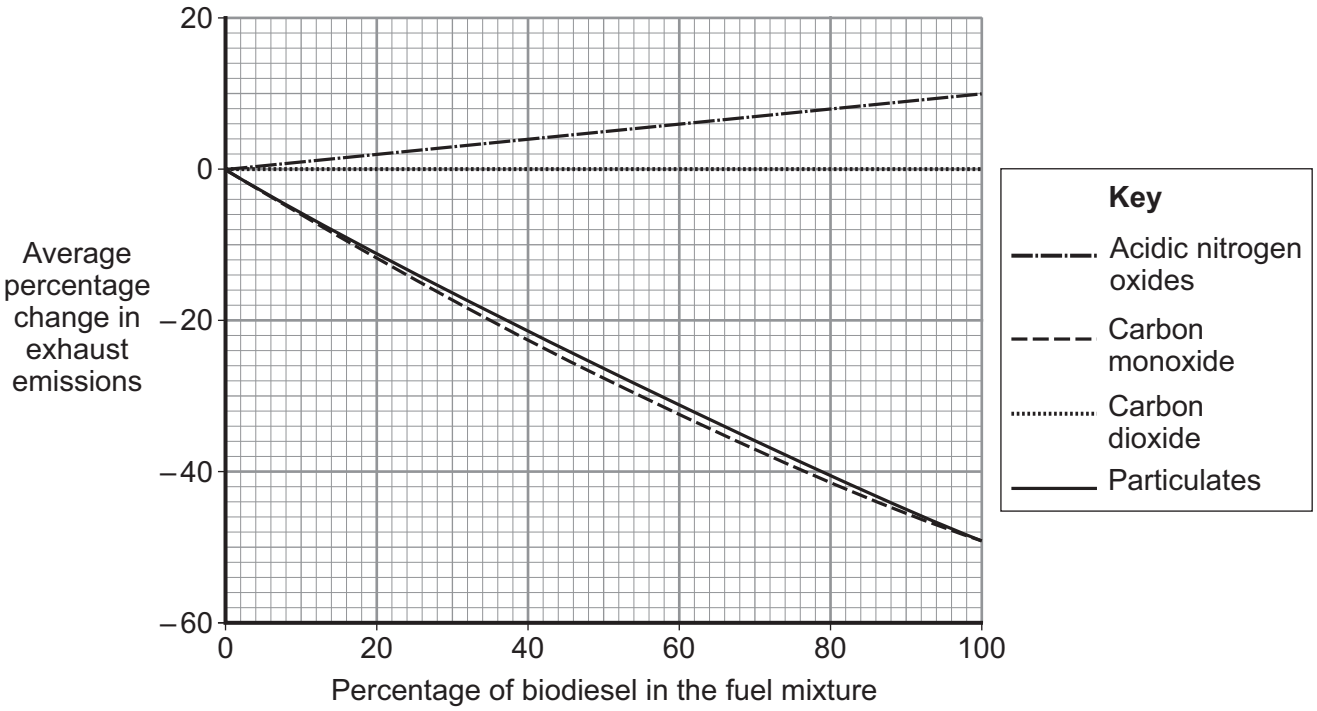
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6 Petroleum diesel is produced from crude oil.

Most vehicles that use petroleum diesel as fuel can also use biodiesel or a mixture of these two fuels. In the UK (in 2010) there must be 5% biodiesel in all petroleum diesel fuel.

Biodiesel is produced from plant oils such as soya. The crops used to produce biodiesel can also be used to feed humans. The benefit that biodiesel is 'carbon neutral' is outweighed by the increasing demand for crops. This increasing demand is causing forests to be burnt to provide land for crops to produce biodiesel. Only a huge fall in the price of petroleum diesel would halt the increasing use of biodiesel.

The graph shows the average percentage change in exhaust emissions from vehicles using different mixtures of petroleum diesel and biodiesel.



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There is no difference in carbon dioxide emissions for all mixtures of petroleum diesel and biodiesel.

Use the information and your knowledge and understanding to evaluate the use of plant oils to produce biodiesel.

Remember to give a conclusion to your evaluation.

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(5 marks)

5

END OF QUESTIONS

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Version: 05/08/2011



General Certificate of Secondary Education

Science B 4462 / Chemistry 4411

CHY1H Unit Chemistry 1

Mark Scheme

2011 examination – June series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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CHY1H

Question 1

question	answers	extra information	mark
1(a)(i)	A	allow –11	1
1(a)(ii)	as the percentage of unsaturated fat decreases the melting point increases **or** vice versa	ignore boiling point / temperature ignore pattern linked to the percentage of saturated fat ignore numerical values	1
1(a)(iii)	D	allow 10	1
1(b)	any **one** from: • increase the melting point • make it 'spreadable' • make it solid (at room temperature) • increase the % of saturated fat **or** decrease the % of unsaturated fat	do **not** accept to make it less healthy **or** more healthy ignore boiling point allow make it hard(er) ignore density / mass / viscous / thicker allow make it saturated ignore references to double / single bonds	1
1(c)	stop people eating unhealthy fat		1
Total			**5**

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CHY1H

Question 2

question	answers	extra information	mark
2(a)(i)		if (fractional) distillation / hydrogenation mentioned as the method = max 1	
	heat / high temperature / hot / vaporise	allow thermal decomposition ignore evaporation do **not** accept 'burns' do **not** accept temperature < 100	1
	catalyst **or** silica / alumina / porous pot **or** steam	ignore other named catalyst allow heat (the vapour) to a very high temperature / >800°C for **2** marks	1
2(a)(ii)	C_2H_3Cl	ignore attempts to balance equation	1
2(a)(iii)	single bonds between C – H, C – Cl **and** C – C	do **not** accept symbols outside the bracket	1
2(b)(i)	so that the amount of plasticiser / (sample of) PVC is the independent / only variable that affects the bending / flexibility of the samples	allow because different sizes would give different results accept because size is a control variable ignore references to reliability / precision etc	1
2(b)(ii)	to improve the reliability (of the investigation)	accept to calculate a mean accept to check for anomalous results **or** to check the range of results ignore accuracy / precision etc	1

Question 2 continues on the next page . . .

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CHY1H

Question 2 continued . . .

question	answers	extra information	mark
2(b)(iii)	23	correct answer with or without working = **2** marks if answer is incorrect allow $\frac{22+23+24}{3}$ **or** 21 for **1** mark	2
2(b)(iv)	(PVC) sample had been stretched / used / tested in first three tests	accept higher temperature allow worn **or** become weaker ignore (human) error ignore more flexible / softer ignore intermolecular forces	1
2(c)	does not bend (easily / much) **or** it is not flexible **or** it is rigid	ignore non-biodegradable / low maintenance ignore sturdy / stronger / harder	1
Total			**10**

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CHY1H

Question 3

question	answers	extra information	mark
3(a)		any mention of molecules / compounds = max **1** allow ions for particles throughout it = brass	
	brass is an alloy **or** brass is a mixture (of metals) **or** brass has different sized / types of atoms / particles	accept brass does not have a regular structure **or** has a disrupted / irregular structure	1
	or in copper all the atoms / particles are the same **or** are the same size / type	accept copper has a regular structure	
	(so) in brass layers / atoms / particles cannot (easily) slide **or** in copper layers / atoms / particles can slide (more easily)	ignore moves easier	1
3(b)(i)	(thermal) decomposition	accept endothermic (reaction) do not accept combustion / burning	1
	by heating	accept in a furnace / kiln	1
3(b)(ii)		they = zinc or lead	
	carbon is more reactive than lead / zinc		1
	(so) lead / zinc oxide is reduced **or** oxygen is removed (by carbon)	accept so lead / zinc oxide reacts with carbon / carbon monoxide accept carbon displaces zinc / lead (from their oxide) allow carbon reacts with the oxygen accept word equation **or** balanced symbol equation	1

Question 3 continues on the next page . . .

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CHY1H

Question 3 continued . . .

question	answers	extra information	mark
3(b)(iii)	(zinc separates / escapes because) zinc boils / turns to a gas (at the temperature of the furnace) **or** the boiling point of zinc is below the temperature of the furnace	ignore density ignore evaporates	1
	lead separates because it melts but does not boil **or** the temperature of the furnace is above the melting point of lead but below its boiling point	ignore density accept lead is molten for lead melts if no other mark awarded allow **1** mark for they (zinc and lead) have different boiling points **or** zinc's boiling point is lower than lead's or vice versa	1
Total			**8**

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CHY1H

Question 4

question	answers	extra information	mark
4(a)	any **two** from: • improve the colour / appearance • additives are permitted / not banned / listed on the label • link between additives and hyperactivity not proved • maintain the low cost of the drink **or** natural colours would make the drink cost more	ignore reference to taste / shelf-life / sales etc allow cheaper if qualified	2
4(b)	have a control group / placebo **or** test children before any drink given give a drink to at least 3 groups **or** give a drink at least 3 times give each additive to different group / children / at different times observe / monitor / compare behaviour of group / children		1 1 1 1
4(c)(i)	so that there would be trust / respect / no bias		1
4(c)(ii)	compare the colours / spots from the orange drink with those of the (three) additives there should be no matching colours / spots	accept diagram of chromatogram(s) with spots for E102, 104, 110 and sample	1 1
Total			**9**

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CHY1H

Question 5

question	answers	extra information	mark
5(a)	complete diagram with 2 carbon atoms and 5 hydrogen atoms each C–C and each C–H linked by a single line (bond)		1
5(b)(i)	the greater the number of (carbon) atoms (in an alkane molecule) the greater its boiling point **or** vice versa	allow as the (carbon) chain gets longer the boiling point increases ignore melting points do **not** accept reference to greater number of molecules	1
5(b)(ii)	any **two** from: • low boiling point / volatile • low viscosity • high flammability • small molecules • burn completely	they = hydrocarbons from the graph it = $C_{30}H_{62}$ accept they are gases or liquids accept easier to burn / ignite accept short chains ignore number of carbon atoms ignore speed of burning	2
5(c)(i)	16 (CO_2) + 18 (H_2O)		1
5(c)(ii)	(carbon dioxide in the Earth's early) atmosphere	accept from volcanoes (millions of years ago) **or** from dead plants / animals allow dead sea creatures ignore shells	1

Question 5 continues on the next page . . .

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CHY1H

Question 5 continued . . .

question	answers	extra information	mark
5(c)(iii)	increase in burning / use of fossil fuels		1
	locked up carbon (carbon dioxide) is released	allow carbon / carbon dioxide from millions of years ago is released accept extra carbon dioxide is not 'absorbed' (by the carbon cycle)	1
Total			**8**

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Question 6

question	answers	extra information	mark
6	any **four** from: **Arguments for biodiesel** max **three** from: • sustainable / renewable • (carbon neutral) absorbs CO_2 when growing / during photosynthesis • burning biodiesel produces low amounts particulates / carbon monoxide • can use waste vegetable oils / fats (from food industry) **or** can use waste plant material • can be used to conserve crude oil (instead of / mixed with petroleum diesel) • produced by a low energy / temperature process • biodegrades (easily) **Arguments against biodiesel** max **three** from: • creates food shortages • deforestation to plant more crops leads to loss of habitat / biodiversity **or** deforestation leads to a reduction in absorption of CO_2 • burning biodiesel produces high amounts of nitrogen oxides • crops takes time to grow • vast areas of land needed to grow crops conclusion supported by the argument presented, which must give added value to the points for and against given above	to gain **4** marks both pros and cons should be given allow burning biodiesel produces little / low amount of global dimming ignore sulfur dioxide accept produced by a low tech process ignore engine effects accept price of food increases allow burning trees increases CO_2 allow deforestation increases global warming allow increases acid rain allow crops can fail	4 1
Total			**5**

The AQA UMS Conversion Calculator is available on the Results statistics page of the AQA Website

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

General Certificate of Secondary Education
Higher Tier
January 2011

Science B
Unit Chemistry C1

Chemistry
Unit Chemistry C1

CHY1H

H

Written Paper

Monday 17 January 2011 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed
- 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice
- In all calculations, show clearly how you work out your answer.

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Do not write outside the box

Answer **all** questions in the spaces provided.

1 The flow diagram shows the main stages used to extract a metal from its ore.

mining the ore → purifying the ore → extracting the metal

The table shows some information about three metals.

Metal	Metal ore	Purified ore	% of metal in the ore	% of metal in the Earth's crust
aluminium	bauxite	aluminium oxide, Al_2O_3	28.0	8.0
copper	chalcocite	copper sulfide, Cu_2S	0.5	0.001
iron	haematite	iron oxide, Fe_2O_3	29.0	5.0

1 (a) Use the information in the table and your knowledge and understanding to help you to answer the questions.

1 (a) (i) Suggest why purifying the copper ore produces large quantities of waste.

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(1 mark)

1 (a) (ii) Suggest why the annual world production of iron is forty times greater than that of aluminium.

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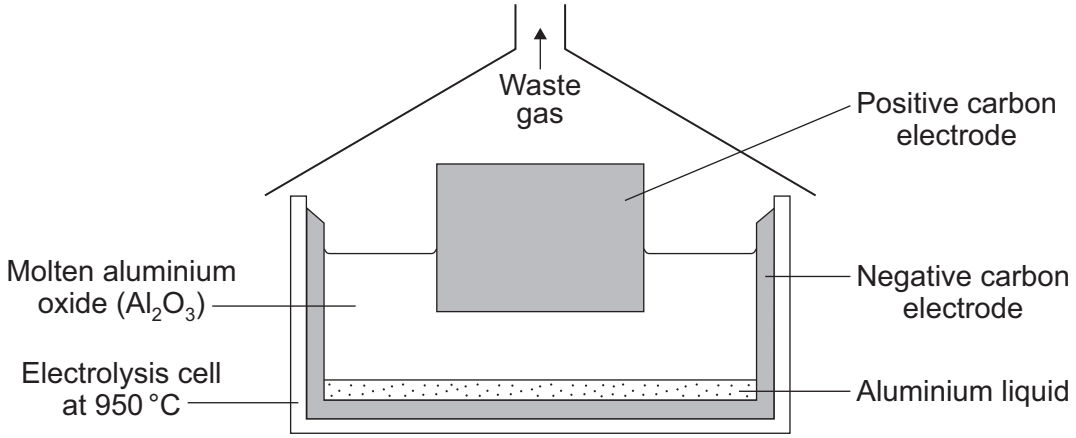
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(1 mark)

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1 (b) Aluminium is used for drinks cans.
Aluminium is extracted from its purified ore by electrolysis.



1 (b) (i) Suggest why the aluminium produced in the electrolysis cell is a liquid.

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(1 mark)

1 (b) (ii) In this electrolysis, aluminium and oxygen gas are produced from the aluminium oxide.

Use the information in the diagram to suggest why most of the waste gas is carbon dioxide and not oxygen.

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(2 marks)

1 (b) (iii) Aluminium is the most abundant metal in the Earth's crust.

Suggest **two** reasons why we should recycle aluminium drinks cans.

1 .....

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2 .....

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(2 marks)

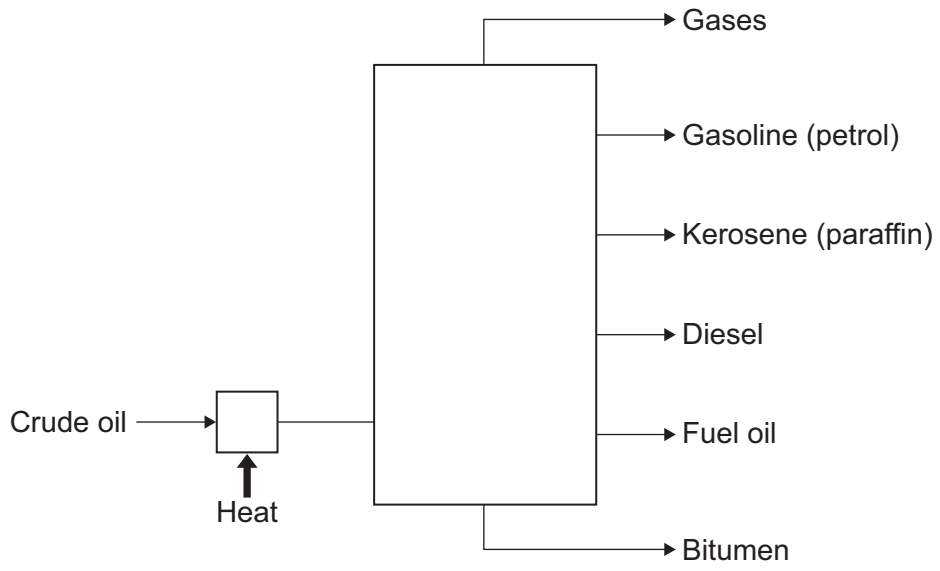
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2 Crude oil is used to produce many useful materials.

2 (a) The diagram shows some of the fractions produced from crude oil by fractional distillation.



Use the diagram to help you to explain how crude oil is separated into fractions.

You should use the words evaporated and condensed in your answer.

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(3 marks)

Do not write outside the box

2 (b) The table shows some information about four of the fractions from crude oil that are used as fuels.

Fraction	Boiling point in °C	Number of carbon atoms found in the molecules
Gasoline (petrol)	20 – 200	5 – 10
Kerosene (paraffin)	180 – 260	10 – 16
Diesel	260 – 340	14 – 20
Fuel oil	370 – 600	20 – 70

Use the information in the table to help you to answer these questions.

2 (b) (i) How can you tell that each of the fractions is a mixture?

.....

.....

(1 mark)

2 (b) (ii) How does the number of carbon atoms in a molecule affect its boiling point?

.....

.....

(1 mark)

2 (c) Fuels are substances that release energy.

2 (c) (i) Name the reaction that releases energy from a fuel such as gasoline (petrol).

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(1 mark)

2 (c) (ii) Describe how fuel oil is broken down into smaller, more useful molecules such as gasoline (petrol).

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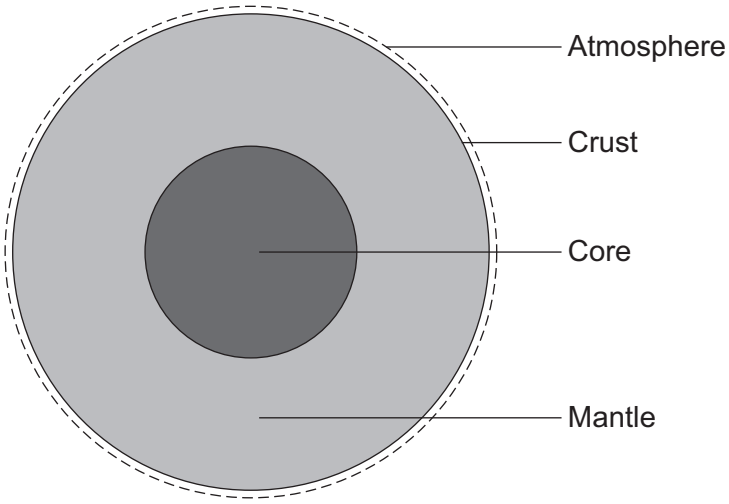
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(2 marks)

8

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3 The Earth has a layered structure and is surrounded by an atmosphere.



3 (a) Scientists believe that the Earth's atmosphere was formed by volcanoes releasing gases.
This early atmosphere was about 95 % carbon dioxide.
The composition of the Earth's atmosphere is always changing.

3 (a) (i) The Earth's atmosphere today contains about 0.035 % carbon dioxide.

What happened to most of the carbon dioxide that was in the Earth's early atmosphere?

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(2 marks)

3 (a) (ii) About 60 million years ago a large meteorite hit the Earth.
This meteorite heated limestone in the Earth's crust causing the release of large amounts of carbon dioxide.

Explain how carbon dioxide is released from limestone.

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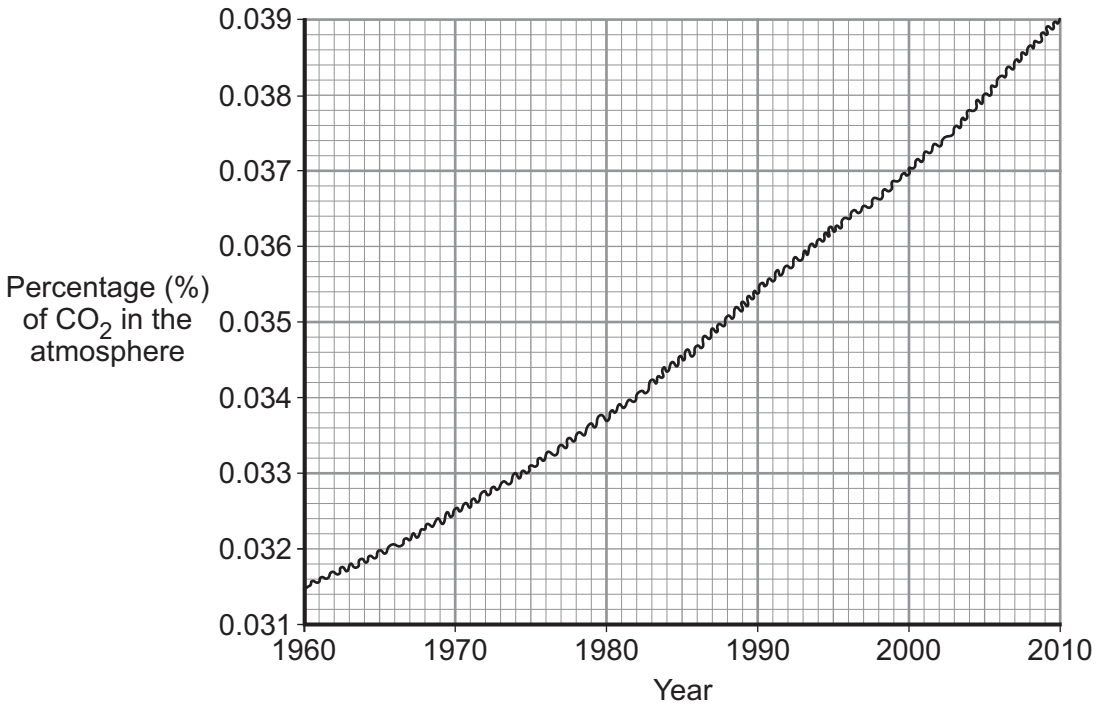
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(2 marks)

Do not write outside the box

3 (b) The graph shows the percentage of carbon dioxide in the Earth's atmosphere over the last 50 years.



Explain, as fully as you can, why we should be concerned about the information displayed on this graph.

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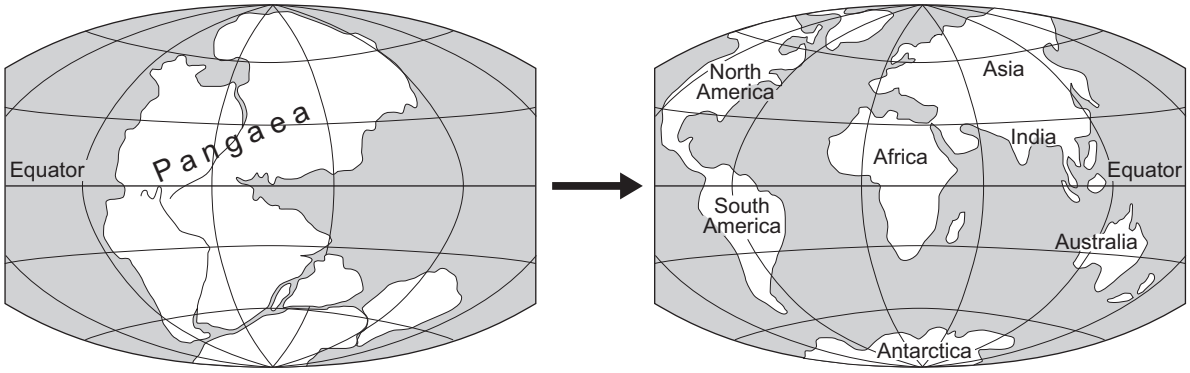
(3 marks)

Question 3 continues on the next page

Turn over ▶

Do not write outside the box

3 (c) Scientists believe that all the continents of the Earth were once joined together. The huge 'supercontinent' was called Pangaea.



200 million years ago **Today**

In 1915, Alfred Wegener had an idea that the change shown in the diagram was caused by *continental drift*. Most scientists could not accept his idea.

3 (c) (i) Suggest why most scientists in 1915 could not accept Wegener's idea of *continental drift*.

.....

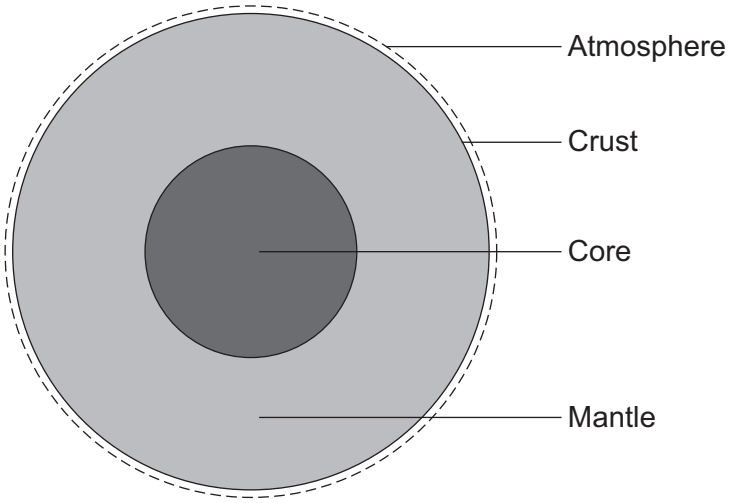
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(1 mark)

Do not write outside the box

To help you with this question, the information and diagram from the beginning of the question are reprinted here.

The Earth has a layered structure and is surrounded by an atmosphere.



3 (c) (ii) Use this information and your knowledge and understanding to explain how continents move.

.....

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(3 marks)

11

Turn over for the next question

Do not write outside the box

4 Titanium is used for replacement hip joints because it has a low density, is strong and does not corrode.
Titanium is extracted from titanium dioxide (TiO_2) in three stages.

4 (a) **Stage 1**
Titanium dioxide is converted into titanium chloride ($TiCl_4$) because the metal cannot be extracted from its oxide by *reduction* with carbon.

4 (a) (i) What does *reduction* mean?

.....

.....

(1 mark)

4 (a) (ii) Balance the chemical equation for the conversion of titanium dioxide to titanium chloride.

TiO_2 + Cl_2 + C → $TiCl_4$ + CO_2

(1 mark)

4 (a) (iii) Chemical equations are always balanced. Explain why.

.....

.....

.....

(1 mark)

4 (b) **Stage 2**
Titanium is extracted from the titanium chloride by reacting it with sodium at 1000 °C in a reactor.
The only other substance in the reactor is argon gas.

$TiCl_4$ + 4Na → Ti + 4NaCl

4 (b) (i) What does this tell you about the reactivity of sodium compared with titanium?

.....

.....

(1 mark)

4 (b) (ii) Suggest why the reactor contains argon and **not** air.

.....

.....

(1 mark)

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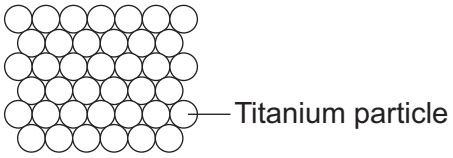
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4 (c) **Stage 3**

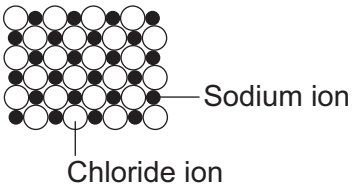
After **Stage 2** the titanium is separated from the products by washing out the sodium chloride with water.

The diagrams show sections through the lattice of titanium metal and the lattice of sodium chloride.

Titanium



Sodium chloride



How do the diagrams show that:

4 (c) (i) titanium is an element

.....

.....

(1 mark)

4 (c) (ii) sodium chloride is a compound?

.....

.....

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(2 marks)

8

Turn over for the next question

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There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

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5 Supermarkets in the UK have been advised by the Government to stop giving plastic bags to customers. The Government states that this is because plastic bags use up resources that are not renewable and that the manufacture of plastic bags produces carbon dioxide.
Most of these plastic bags are made from poly(ethene). The table shows methods to deal with large numbers of used plastic bags.

Method	**Description of what happens to the plastic bag**
Reused	used again by the customer
Recycled	collected, transported, washed and melted to make new plastic items
Burned	collected, transported and burnt to release heat energy
Dumped	mixed with other household waste, collected, transported and disposed of at a landfill site

Use the information and your knowledge and understanding to briefly give **one advantage and one disadvantage** for each of these methods.

Reused .....

.....

.....

Recycled .....

.....

.....

Burned .....

.....

.....

Dumped .....

.....

.....

(4 marks)

4

Do not write outside the box

6 This information about diesel was printed in a magazine.

Almost all of the crops that we eat can be converted into fuel for cars.
Vegetable oils can be used as biodiesel. Diesel from crude oil is called fossil diesel.
When either biodiesel or fossil diesel burn they both produce similar amounts of carbon dioxide.
Both types of diesel produce carbon monoxide. However, biodiesel produces fewer carbon particles and less sulfur dioxide.

6 (a) Carbon monoxide can be produced when diesel burns in a car engine. Explain how.

.....

.....

.....

.....

(2 marks)

Do not write outside the box

6 (b) Use the information at the start of this question and your knowledge and understanding to evaluate the use of biodiesel compared with fossil diesel as a fuel for cars.

Remember to give a conclusion to your evaluation.

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(5 marks)

7

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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Version : 08/03/2011

General Certificate of Secondary Education

Science B 4462 / Chemistry 4411

CHY1H Unit Chemistry 1

Mark Scheme

2011 examination – January series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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Question 1

question	answers	extra information	mark
1(a)(i)	very little / low percentage of metal (in the ore)	accept only 0.5% metal in the ore **or** over 99% waste in the ore **or** nearly 100% waste in the ore ignore reference to percentage of metal in the Earth's crust **or** energy used or pollution	1
1(a)(ii)	any **one** from • iron uses less energy / fuel for extraction • iron has more uses • more demand for iron • iron is stronger • cheaper / costs less • easier to extract	(it = iron) ignore electrolysis / uses electricity / reactivity ignore high abundance in the Earth's crust / high percentage of metal in ore ignore harder	1
1(b)(i)	has melting point lower than 950°C	(it = aluminium) allow has a low melting point ignore boiling point	1
1(b)(ii)	electrode(s) made of carbon oxygen reacts with electrode(s) / carbon	 accept C + O_2 (→ CO_2) NB oxygen reacts with the carbon electrode(s) = **2** marks	1 1

Question 1 continues on the next page

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CHY1H

Question 1 contd

question	answers	extra information	mark
1(b)(iii)	any **two** from: • saves resources / non renewable • landfill problem • saves energy / fuel / electricity • less carbon dioxide / carbon emissions or reduces carbon footprint • less quarrying / mining	 accept aluminium / ore will run out or conserves aluminium accept aluminium does not corrode ignore global warming ignore consequences of quarrying / mining ignore pollution / harms environment / costs / easy to recycle	2
Total			**7**

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CHY1H

Question 2

question	answers	extra information	mark
2(a)	crude oil / it is evaporated / vaporised vapours / gases / fractions cool and condense (different) vapours / gases / fractions (condense) at different temperatures	ignore heated accept named fraction(s) accept (different) vapours / gases / fractions have different boiling points max **2** marks for description of laboratory method **or** mention of cracking	1 1 1
2(b)(i)	any **one** from: • range of boiling points • range of carbon atoms		1
2(b)(ii)	greater the number (of carbon atoms) the higher the boiling point	do **not** accept molecules / particles	1
2(c)(i)	burning / combustion	allow oxidation / redox	1
2(c)(ii)	any **two** from: • cracking / (thermal) decomposition • heat / vaporise • catalyst / aluminium oxide	reaction with hydrogen gains max of **1** mark only allow porous pot ignore names of other catalysts	2
Total			**8**

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CHY1H

Question 3

question	answers	extra information	mark
3(a)(i)	any **two** from: • used by plants • used for photosynthesis • absorbed / dissolved in oceans • locked up in fossil fuels / limestone / sedimentary rocks	 allow specific plants and algae ignore oxygen released / respiration ignore oceans formed	2
3(a)(ii)	calcium carbonate / $CaCO_3$ decomposed / thermal decomposition	 do **not** allow reaction with oxygen accept quicklime / calcium oxide produced $CaCO_3 \rightarrow CaO + CO_2$ gains **2** marks	1 1
3(b)	increasing (CO_2 or global warming) <u>more rapid</u> increase recently carbon dioxide causes global warming	 accept greenhouse gas **or** climate change / sea level rising **or** ice caps melting do **not** accept ozone layer or acid rain or global dimming	1 1 1

Question 3 continues on the next page

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CHY1H

Question 3 contd

question	answers	extra information	mark
3(c)(i)	any **one** from: • Wegener had no evidence / proof • other scientists had different ideas / views • did not respect Wegener as a scientist / geologist	accept movement too slow to measure accept continents / plates fixed or land bridge	1
3(c)(ii)	any **three** from: • plates (move) • heat energy / radioactivity (causes) • convection currents • in mantle	ignore continents	3
Total			**11**

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CHY1H

Question 4

question	answers	extra information	mark
4(a)(i)	removal of oxygen	accept definition in terms of electrons **or** oxidation numbers ignore oxides	1
4(a)(ii)	2 (Cl_2)	allow correct multiples	1
4(a)(iii)	no atoms are lost / made (during a chemical reaction) **or** the atoms are rearranged (during a chemical reaction)	accept because of (the law of) conservation of mass / matter	1
4(b)(i)	sodium is more reactive (than titanium)	accept sodium is very reactive **or** titanium is less reactive do **not** accept sodium is more reactive than argon	1
4(b)(ii)	any **one** from: • sodium / titanium would react with oxygen / air • sodium / titanium does not react with argon	 accept air / oxygen is reactive accept argon is unreactive / inert / a noble gas / in group O	1
4(c)(i)	all atoms are the same / it only contains one type of atom	accept all ions are the same do **not** accept only got one atom do **not** accept all atoms are the same size ignore particles	1
4(c)(ii)	two different / types atoms / elements / ions bonded / joined together	accept more than one type of atom / ion / element do **not** accept different size accept definite proportions do **not** accept mixture	1 1
Total			**8**

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CHY1H

Question 5

Question	Advantages	Disadvantages	
Reused	• saves raw materials / crude oil • saves energy / fuel / transport • fewer bags needed / made • reduces carbon / CO_2 emissions • reduces use of landfill • saves cost of a new bag • no waste	• unable to reuse many times • bags easily split	1
Recycled	• saves raw materials / crude oil • saves energy / use of fuel • reduces carbon / CO_2 emissions • reduces use of landfill • can be used for new products	• has to be collected / transported / washed / separated / melted ignore uses energy	1
Burned	• heat / energy released can be used (for heating / generating electricity) • reduces use of landfill	• has to be collected / transported • wastes the resource / plastic • releases harmful gases / toxic gases / CO_2	1
Dumped	• collected / transported with household waste • (slowly) biodegrades **or** produces methane which can be used as a fuel • (not biodegradable so) does not release CO_2 / green house gas into the air	• wastes the resource • plastic uses landfill • produces methane which is a greenhouse gas / could cause explosions • not biodegradable / take years to decompose	1
ignore cost / litter / waste / global warming / habitats unless mentioned above			

Total			**4**

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CHY1H

Question 6

question	answers	extra information	mark
6(a)	carbon / diesel / it reacts / burns in oxygen / air		1
	limited supply (of oxygen / air)	accept incomplete combustion $2C + O_2 \rightarrow 2CO$ **or** $C + CO_2 \rightarrow 2CO$ gains **2** marks	1
6(b)	any **four** from: for biodiesel: • less global dimming (because fewer carbon particles) • less acid rain (because less sulfur dioxide) • renewable resource / sustainable • use waste vegetable oils / fats • vegetables / plants absorbed carbon dioxide / carbon neutral • uses land which could be used to produce food • third world countries can produce bio diesel • biodegrades easily • more NOx released justified conclusion	accept converse statements for fossil diesel. ignore cost / ease of manufacture / usage issues if neither point awarded, fewer carbon particles and less sulfur dioxide = **1** mark accept fossil fuel / diesel supplies are limited accept fossil fuel / diesel releases locked up carbon / is not carbon neutral	4 1
Total			**7**

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2010

Science B
Unit Chemistry C1

Chemistry
Unit Chemistry C1

CHY1H

H

Written Paper

Wednesday 16 June 2010 9.00 am to 9.45 am

You will need no other materials.
You may use a calculator.

Time allowed
- 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice
- In all calculations, show clearly how you work out your answer.

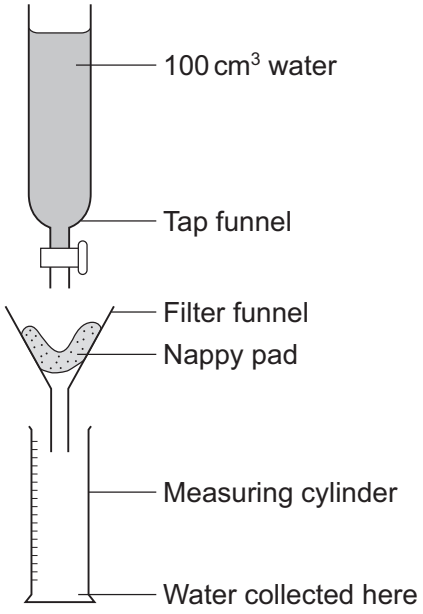
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Answer **all** questions in the spaces provided.

1 Disposable nappies for babies need to absorb as much water as possible. Disposable nappies have a pad containing a special polymer called a hydrogel. Hydrogels absorb water.

A company called Aqanaps compared the water absorption of its nappy pads with nappy pads made by other companies.



- A scientist from Aqanaps poured 100 cm^3 of water onto the pad of one of its nappies.
- He measured the volume of water that passed through.
- He did the test three times using a new nappy pad for each test.
- The scientist then repeated the procedure using the nappy pads from three other companies, **A**, **B** and **C**.

The results are shown in the table.

Company	**Volume of water collected in cm^3**		
	Pad 1	**Pad 2**	**Pad 3**
Aqanaps	55	57	55
A	47	46	39
B	65	63	64
C	38	39	38

Do not write outside the box

1 (a) (i) Choose **one** result in the table that should be tested again.

Result: Company ..... Pad .....

Explain why you chose this result.

.....

.....

.....

(2 marks)

1 (a) (ii) Suggest **one** variable that should be controlled in this investigation.

.....

.....

(1 mark)

1 (a) (iii) Suggest **one** possible cause of error in this investigation.

.....

.....

(1 mark)

1 (b) (i) The Aqanaps company studied the results. The company concluded that it should increase the amount of hydrogel used in its nappy pads.

Give **two** reasons why the company decided to increase the amount of hydrogel used in its nappy pads.

1 .....

.....

2 .....

.....

(2 marks)

1 (b) (ii) Suggest **one** disadvantage for the company if it increases the amount of hydrogel used in its nappy pads.

.....

.....

(1 mark)

7

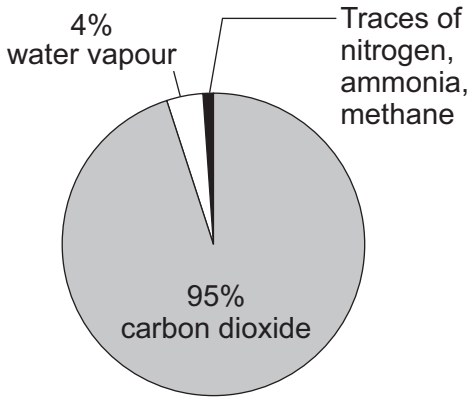
Do not write outside the box

2 (a) Scientists have suggested that:

- the Earth formed as a molten ball of rock and minerals
- the rock and minerals cooled slowly
- the surface of the Earth was covered by volcanoes
- the volcanoes released gases that formed the Earth's early atmosphere.

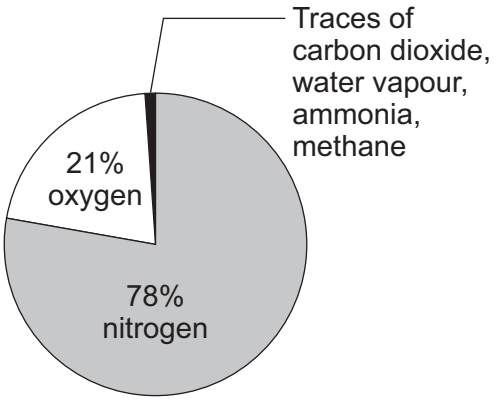
The pie charts show the approximate percentages of gases in the Earth's early atmosphere and in the Earth's atmosphere today.

Earth's early atmosphere



Average surface temperature above 400 °C

Earth's atmosphere today



Average surface temperature 20 °C

2 (a) (i) Explain what has happened to most of the water vapour in the Earth's early atmosphere.

.....

.....

.....

.....

(2 marks)

2 (a) (ii) Give **two** reasons why the percentage of carbon dioxide in the Earth's early atmosphere decreased.

1 .....

.....

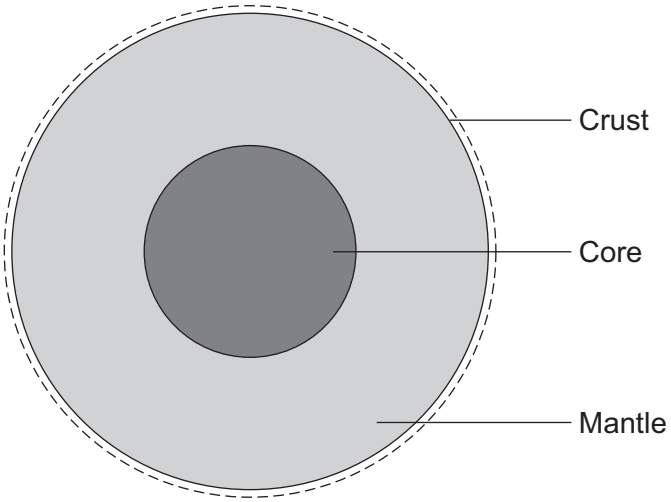
2 .....

.....

(2 marks)

Do not write outside the box

2 (b) Scientists have suggested that the Earth consists of a core, mantle and crust.



A 'traditional' theory is that the core is made of iron and nickel.

A 'controversial' theory is that the core is like a nuclear reactor made of the radioactive elements uranium and plutonium.

2 (b) (i) Why can scientists **not** prove which theory about the core is correct?

.....

.....

(1 mark)

2 (b) (ii) How can the 'controversial' theory be used to explain why the Earth's tectonic plates move?

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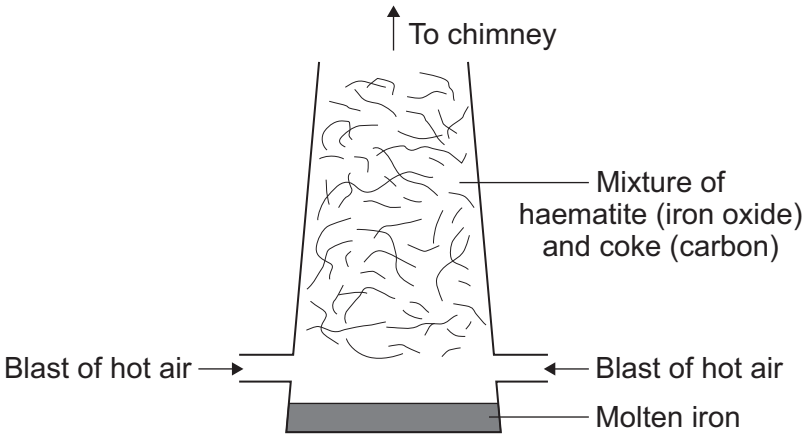
(3 marks)

8

Turn over ▶

Do not write outside the box

3 Iron is produced by reacting a mixture of haematite and coke in a blast furnace.
Haematite is an ore of iron containing iron oxide (Fe_2O_3).
Coke is made from coal and is almost pure carbon.



3 (a) (i) The coke burns in air. This reaction heats the furnace to above 1300 °C.

Complete the chemical equation for carbon reacting with oxygen to form carbon dioxide.

..... + O_2 → CO_2

(1 mark)

3 (a) (ii) Carbon monoxide is also formed in the furnace. Carbon monoxide reacts with iron oxide to produce iron and carbon dioxide.

iron oxide + carbon monoxide → iron + carbon dioxide

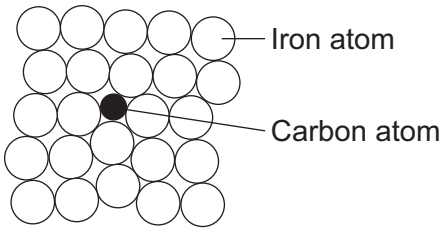
Complete and balance the chemical equation for the production of iron.

Fe_2O_3 + 3CO → ..... + ...

(2 marks)

Do not write outside the box

3 (a) (iii) Iron from a blast furnace is called cast iron and contains about 4% carbon.



Why is pure iron softer than cast iron?

.....

.....

.....

(1 mark)

3 (b) Steel is made by reducing the percentage of carbon in cast iron and then adding different metals to form the type of steel required.

In the UK we use about 1.8 billion steel cans every year but only 30% of these are recycled. Recycling reduces waste. Producing steel from recycled cans requires only 25% of the energy needed to make steel from iron ore.

Give **three** environmental benefits of recycling a higher percentage of used steel cans.

1 .....

.....

2 .....

.....

3 .....

.....

(3 marks)

7

Turn over for the next question

Do not write outside the box

4 Medical evidence suggests that eating saturated fats, compared with unsaturated fats, is associated with a higher risk of circulatory and heart problems.

Each of the oils listed in the table contains a mixture of saturated and unsaturated fats.

Oil	Melting point in °C	Iodine number
palm	24	54
olive	–6	85
rapeseed	–10	98
sunflower	–17	127

The iodine number is the mass of iodine in grams that reacts with 100 cm^3 of the oil. The iodine number shows the amount of unsaturated fat in each oil.

4 (a) (i) What would be seen if a solution containing 1 g of iodine was added to 100 cm^3 of any of these oils?

.....

.....

(1 mark)

4 (a) (ii) What does the word *unsaturated* mean?

.....

.....

(1 mark)

4 (a) (iii) Which oil in the table would **probably** cause the highest risk of circulatory and heart problems?

Use the information in the table to give a reason for your answer.

Oil .....

Reason .....

.....

.....

.....

(2 marks)

Do not write outside the box

4 (b) Sunflower oil can be hardened so that it can be used to make margarine.

Explain how sunflower oil can be hardened.

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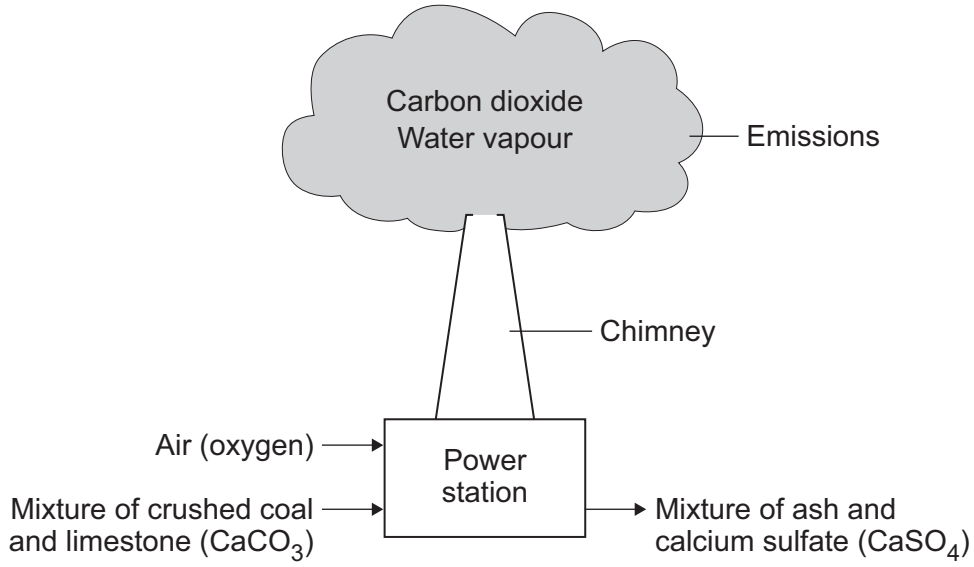
(3 marks)

7

Turn over for the next question

Do not write outside the box

5 Most power stations burn coal to generate electricity. Burning coal gives off sulfur dioxide gas which can be removed from the waste gases by using limestone. This prevents sulfur dioxide from entering the atmosphere and causing acid rain. One disadvantage of using limestone in a power station is that it releases 'locked up carbon dioxide' into the atmosphere.



5 (a) How does the limestone used in a power station:

5 (a) (i) release carbon dioxide

.....

.....

(1 mark)

5 (a) (ii) remove sulfur dioxide?

.....

.....

(1 mark)

Do not write outside the box

5 (b) The waste gases from the chimney are monitored. One toxic gas that should not be released is carbon monoxide.

Explain how carbon monoxide would be formed.

.....

.....

.....

.....

(2 marks)

5 (c) The use of limestone in a power station releases 'locked up carbon dioxide' into the atmosphere.

5 (c) (i) Explain the meaning of 'locked up carbon dioxide'.

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(2 marks)

5 (c) (ii) Why does the release of this carbon dioxide cause an environmental problem?

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(1 mark)

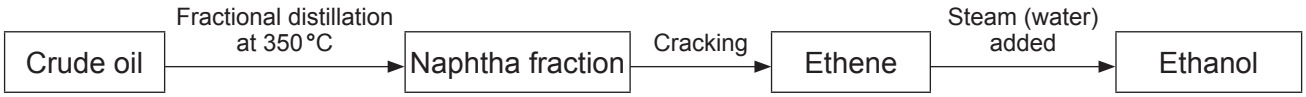
7

Turn over for the next question

Do not write outside the box

6 Petrol sold in most countries now contains at least 5% ethanol.
The production of ethanol, for use as a fuel, is being increased.

The flow diagram shows how ethanol can be produced from crude oil.



6 (a) Why does crude oil need to be fractionally distilled?

.....

.....

(1 mark)

6 (b) Hydrocarbons, such as decane, in the naphtha fraction are cracked to produce ethene.
The balanced chemical equation shows the cracking of decane.

$$\underset{\text{decane}}{C_{10}H_{22}} \rightarrow \underset{\text{octane}}{C_8H_{18}} + \underset{\text{ethene}}{C_2H_4}$$

6 (b) (i) Describe how cracking is done.

.....

.....

.....

.....

(2 marks)

6 (b) (ii) Complete the structural formula of ethene by drawing lines to represent each covalent bond.

H H

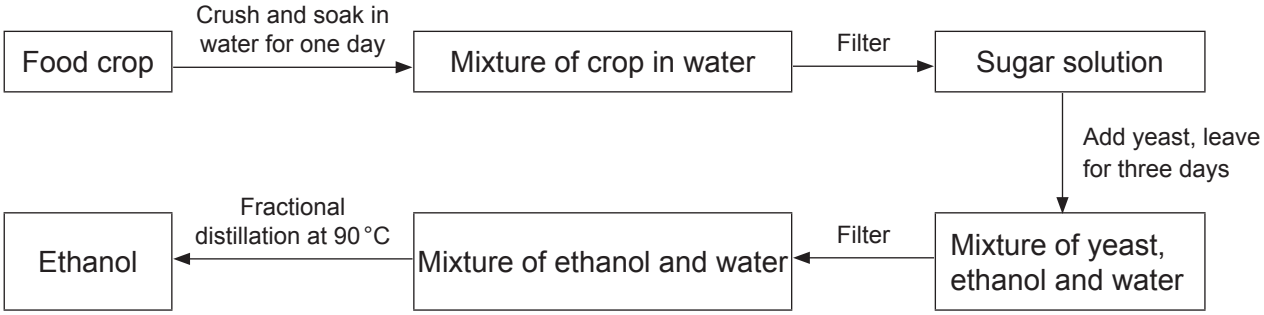
C C

H H

(1 mark)

Do not write outside the box

6 (c) The flow diagram below shows how ethanol, for use as a fuel, can also be produced from food crops.



Use the information in the two flow diagrams and your own knowledge and understanding to evaluate whether more of this ethanol should be produced from food crops or from crude oil.

Remember to give a conclusion to your evaluation.

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(5 marks)

9

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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Version: 17/08/2010

General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit Chemistry 1

Mark Scheme

2010 Examination – June Series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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

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Marking Guidance for Examiners

GCSE Science Papers

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:

where consequential marking needs to be considered in a calculation;

or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct

substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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CHY1H

Question 1

question	answers	extra information	mark
1(a)(i)	A **and** 3 anomalous result	accept A **and** 39 independent mark accept not close to other two volumes **or** correct comparison using the results ignore does not fit the pattern	1 1
1(a)(ii)	any **one** from: • volume of water (used) • time (for water to run through) • temperature • mass / surface area of pad • same filter funnel	 allow amount of water (used) accept rate / speed (at which water runs through) accept amount / size / volume / thickness of pad ignore other equipment	1
1(a)(iii)	any **one** from: • incorrect / volume / amount of water added • reading / volume / amount of water collected • some water does not go through the pad • not enough time allowed for water to drain through • pads (from one company) not identical / faulty	ignore human error unqualified allow spillage / poorly placed pad accept rate / speed at which water is added	1

Question1 Continues on the next page

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CHY1H

Question 1 continued

question	answers	extra information	mark
1(b)(i)	any **two** from: • it was not the best (at absorbing the water) • (needed) to absorb more (water) • to improve their image / sales	accept correct descriptions of 'not the best' / third best **or** only better than B allow not absorbing enough (water) accept (needs) to absorb more (water) than A and C for **2** marks	2
1(b)(ii)	any **one** from: • cost (more) • use (more) resources • use (more) energy	must relate to the company	1
Total			**7**

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CHY1H

Question 2

question	answers	extra information	mark
2(a)(i)	condensed	it = water vapour accept temperature went below 100°C / boiling point of water allow cooled to form liquid / water / rain do **not** accept evaporated	1
	formed the oceans / seas	ignore rain accept (water vapour) cooled and formed the ocean / sea for **2** marks	1
2(a)(ii)	any **two** from: • used by (green) plants / algae • changed into oxygen • dissolved in oceans / seas • (locked up) in carbonates / sedimentary rocks • (locked up) in fossil fuels / named fossil fuel	ignore oxygen / nitrogen increased ignore reference to volcanoes / respiration accept photosynthesis / plants give out oxygen accept (locked up) in shells / skeletons (of animals)	2
2(b)(i)	cannot get to / reach / drill to / see the core	accept the core is (too) far down (into the Earth) / do not know what happens under the crust / Earth's surface accept it is (too) hot / radioactive ignore lack of evidence unqualified	1

Question 2 continues on the next page

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CHY1H

Question 2 continued

question	answers	extra information	mark
2(b)(ii)	any **three** from: • heat / energy released • from radioactive decay / processes • (causing) convection currents • in the mantle	accept radioactivity / nuclear reactions	3
Total			**8**

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CHY1H

Question 3

question	answers	extra information	mark
3(a)(i)	C	must be correct symbol do **not** accept carbon any balancing must be correct	1
3(a)(ii)	Fe + CO_2 2…. + 3….	correct formulae correct balancing allow Fe_2 + $3CO_2$ for this mark	1 1
3(a)(iii)	layers / atoms in pure iron are able to slide over each other **or** layers / atoms in cast iron are unable to slide over each other (easily)	it = pure iron accept ions for atoms ignore molecules / particles	1

Question 3 continues on the next page

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CHY1H

Question 3 continued

question	answers	extra information	mark
3(b)	any **three** from: • less iron ore used • less other metals extracted / used to make different steels • less fuel used • less specified pollution • less / no landfill space needed • less / no mining needed **or** fewer specified effects of mining	mention of ozone = max **2** accept the idea that ores would be conserved but not unspecified conservation accept the idea that ores would be conserved but not unspecified conservation accept the idea that fuels would be conserved ignore reduces energy requirements accept global warming / greenhouse effect / CO_2 / CO / carbon emissions / acid rain / SO_2 / global dimming / do **not** accept ozone layer ignore reduces waste accept effect such as eyesore / loss of habitat eg 'less mining iron ore' = **2** marks	3
Total			**7**

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Question 4

question	answers	extra information	mark
4(a)(i)	(iodine is) decolourised	accept colourless allow oil decolourised ignore initial colour of iodine / nothing / clear	1
4(a)(ii)	(molecule / compound) has a double (carbon carbon) bond	allow C = C	1
4(a)(iii)	palm any **one** from: • contains less / low amount of unsaturated fat(s) • contains more / high amount of saturated fat(s)	 only allow this mark if correct **or** no answer in first part ignore references to iodine number / melting point	1 1
4(b)	any **three** from: • (react with*)* hydrogen • with a (nickel) catalyst • at about 60°C • increase *the* melting point	cracking / emulsification = max **2** accept by hydrogenation do **not** accept cracking / emulsify allow hot **or** range 50°C to 120°C	3
Total			**7**

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CHY1H

Question 5

question	answers	extra information	mark
5(a)(i)	(thermal) decomposition	allow it breaks down accept symbol equation or in words allow reaction with SO_2 (to form CO_2)	1
5(a)(ii)	calcium carbonate / calcium oxide / limestone / quicklime / it reacts with sulfur dioxide / forms calcium sulfate	accept it neutralises sulfur dioxide / neutralisation ignore references to sulfur do not accept 'calcium reacts with…'	1
5(b)	by incomplete / partial combustion (of the fuel) insufficient oxygen / *air* (to burn fuel)	 accept insufficient oxygen / *air* to burn fuel completely for **2** marks if no other marks awarded accept $C + CO_2 \rightarrow 2CO$ **or** $2C + O_2 \rightarrow 2CO$ **or** in words for **1** mark	1 1

Question 5 continues on the next page

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CHY1H

Question 5 continued

question	answers	extra information	mark
5(c)(i)	any **two** from: • (CO_2) from the atmosphere • (CO_2) taken in millions of years ago **or** early (atmosphere) • (CO_2) was used to form the shells / skeletons of marine organisms / fossil fuels	allow thousands / billions allow rocks formed millions of years ago accept sedimentary rocks allow used to form correct named fossil fuel ignore limestone	2
5(c)(ii)	any **one** from: • *(*increases / enhances*)* global warming • is additional carbon dioxide **or** not able to be absorbed by oceans / seas **or** used by (green) plants • acidification of sea water	allow greenhouse gas / effect do **not** accept ozone layer / acid rain / global dimming ignore consequences of global warming	1
Total			**7**

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CHY1H

Question 6

question	answers	extra information	mark
6(a)	it is a mixture (of hydrocarbons) **or** contains hydrocarbons with different boiling points	accept 'to separate (crude) oil (into fractions) **or** obtain the naphtha (fraction) accept to get useful products ignore removal of impurities	1
6(b)(i)	heat / vaporise	mention of hydrogen = max **1** accept thermal (decomposition) for heat allow boil do not allow temperatures below 100°C ignore steam	1
	catalyst	allow alumina / porous pot ignore other catalysts	1
6(b)(ii)	4 × C – H **and** C = C	ignore brackets with or without an 'n' before them do not allow poly(ethene)	1

Question 6 continues on the next page

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question	answers	extra information	mark
6(c)	any **four** from: **must** be at least **one** advantage and **one** disadvantage for all four marks	ignore ideas about carbon dioxide formation / photosynthesis or cost / economics / environmentally friendly candidates are only awarded **1** mark if they use equivalent pairs of bulleted points	4
	<u>crops</u> advantages eg: • renewable (resource) / sustainable • low / less energy / fuel needed for process **or** lower temperature [ignore heat or quoted temperatures] • can use waste plant / crop material • carbon neutra*l* • low safety risk (processes) • low technology	<u>crude oil</u> disadvantages eg: • *non*-renewable (resource) / finite / running out • high / more energy needed for process **or** higher temperature • not carbon neutral **or** releases locked up carbon • high safety risk (process) • high technology • risk of major oil spillage • can be used to make other products	
	disadvantages eg: • batch process / process is slow • many steps in the process • ethanol is impure / may contain water • food shortages • need very large areas of (arable) land to grow crops **or** can only grow in certain areas / climates • destruction of woodland / habitat • slow growth of crops • labour intensive	advantages eg: • continuous process / process is fast • few steps in the process • ethanol is pure • 'conserves' food • can accept reverse arguments	
	a conclusion with a reasoned argument based on	there must be at least one advantage and one disadvantage, however, a	

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	valid advantages **and** disadvantages	matched pair, although only awarded one mark would allow the conclusion mark to be awarded	1
Total			**9**

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

AQA

General Certificate of Secondary Education
Higher Tier
January 2010

Science B
Unit Chemistry C1

CHY1H

H

Chemistry
Unit Chemistry C1

Written Paper

Monday 18 January 2010 9.00 am to 9.45 am

You will need no other materials.
You may use a calculator.

Time allowed
- 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice
- In all calculations, show clearly how you work out your answer.

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Areas outside the box will not be scanned for marking

Answer **all** questions in the spaces provided.

1 Rapeseed oil can be used for cooking.

A label on a bottle of rapeseed oil stated:

> Rapeseed oil is healthy because it is
>
> - low in saturated fat
> - high in poly-unsaturated fat.

Two students investigated if the statement was true. They found the following information about four oils.

	Rapeseed oil	**Sunflower oil**	**Olive oil**	**Corn oil**
Saturated fat (%)	6.6	12.0	14.3	14.4
Mono-unsaturated fat (%)	59.3	20.5	73.0	29.9
Poly-unsaturated fat (%)	29.3	63.3	8.2	51.3
Melting point (°C)	5	–18	–12	–15

1 (a) Does this information support the two claims made on the label?
Explain your answers.

1 (a) (i) 'Rapeseed oil is low in saturated fat.'

.....

.....

.....

(1 mark)

1 (a) (ii) 'Rapeseed oil is high in poly-unsaturated fat.'

.....

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

1 (b) Rapeseed oil contains unsaturated fats.

How could the students test the oil to show that it contained unsaturated fats?

Test.....

.....

Result of test .....

.....

(2 marks)

1 (c) Rapeseed oil can be hardened by reacting it with hydrogen.

1 (c) (i) What would happen to the melting point of rapeseed oil if it was hardened?

.....

.....

(1 mark)

1 (c) (ii) One student claimed that hardening would make the rapeseed oil healthier.

Explain why the student is wrong.

.....

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.....

(2 marks)

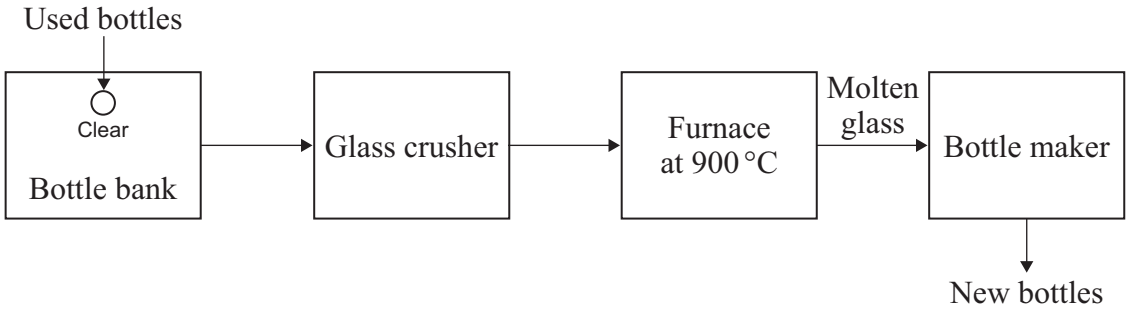
7

Turn over for the next question

Areas outside the box will not be scanned for marking

2 In recent years we have become more aware of the need to recycle glass.

2 (a) Used glass bottles can be recycled if they are put into bottle banks.



2 (a) (i) Suggest **one** reason why light bulbs should **not** be put into bottle banks.

.....

.....

(1 mark)

2 (a) (ii) Very few glass bottles are reused (used more than once).

Suggest **one** reason why.

.....

.....

(1 mark)

2 (a) (iii) New glass bottles can also be produced by heating, at 1700 °C, a mixture of the following raw materials:

sand (silicon dioxide), SiO_2
soda ash (sodium carbonate), Na_2CO_3
limestone (calcium carbonate), $CaCO_3$

Explain why the use of recycled glass to make glass bottles produces less carbon dioxide than making glass bottles from these raw materials.

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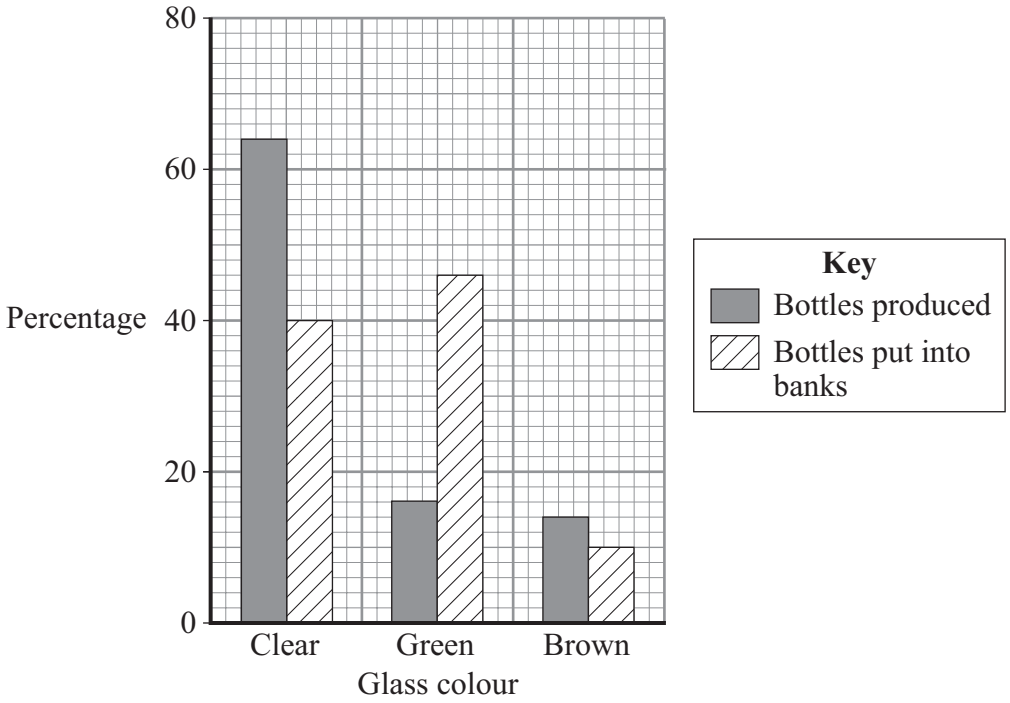
.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

2 (b) The bar chart shows the percentages of glass bottles produced and the percentages of glass bottles put into bottle banks in the UK.



2 (b) (i) The percentage of green glass bottles produced is 16%.
What is the percentage of green glass bottles put into bottle banks?

Percentage = ... %

(1 mark)

2 (b) (ii) More green glass bottles are put into bottle banks than are made in the UK.
Suggest **one** reason why.

.....

.....

(1 mark)

2 (b) (iii) Suggest and explain **one** problem resulting from the percentage of clear glass bottles produced in the UK.

.....

.....

.....

.....

(2 marks)

8

Turn over ▶

Areas outside the box will not be scanned for marking

3 Many human activities result in carbon dioxide emissions.
Our carbon footprint is a measure of how much carbon dioxide we each cause to be produced.

3 (a) Why should we be concerned about our carbon footprint?

.....

.....

.....

(1 mark)

3 (b) Most power stations in the UK burn coal.
Coal was formed from tree-like plants over millions of years.

Suggest why burning wood instead of coal would help to reduce our carbon footprint.

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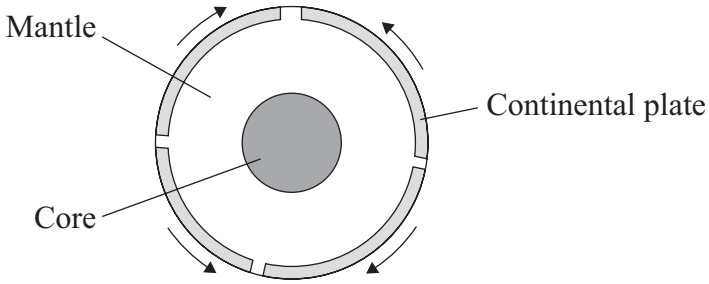
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(3 marks)

4

Areas outside the box will not be scanned for marking

4 In 1915 Wegener proposed his idea of continental drift. About 50 years later the theory of plate tectonics was developed and this confirmed his idea.



4 (a) Give **one** reason why Wegener's idea was not accepted in 1915.

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(1 mark)

4 (b) The theory of plate tectonics is used to explain why earthquakes occur.

Explain how earthquakes occur.

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.....

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.....

(2 marks)

4 (c) Suggest why it is difficult to predict when an earthquake will occur.

.....

.....

.....

(1 mark)

4

Turn over ▶

Areas outside the box will not be scanned for marking

5 In the UK copper is produced from imported blister copper (98% pure), which has been extracted from copper ores.

5 (a) In the first stage of purification, air is blown into molten blister copper to remove any sulfur.

5 (a) (i) The sulfur reacts to form a gas that should **not** be allowed to escape into the atmosphere.

Explain why.

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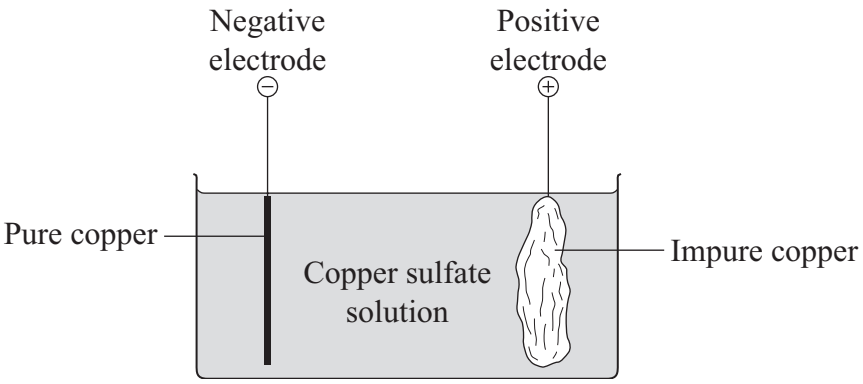
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(2 marks)

5 (a) (ii) After the removal of sulfur the slightly impure copper is cast into anodes. The copper in these anodes is purified by the process shown.



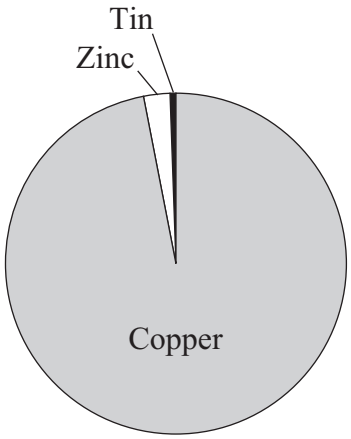
What is the name of this type of process?

.....

(1 mark)

Areas outside the box will not be scanned for marking

5 (b) One use of copper is to make 2p coins.



The composition of a 2p coin in 1991

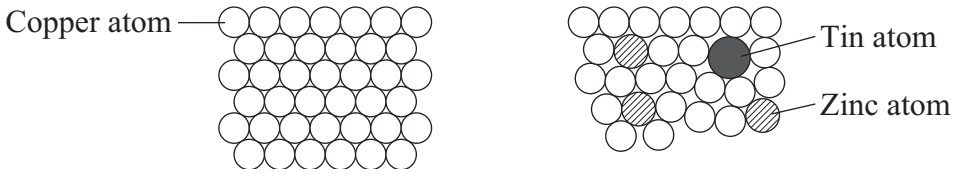
5 (b) (i) How was copper made harder for use in 2p coins in 1991?

.....

.....

(1 mark)

5 (b) (ii) Use the diagrams to help you to explain why the metal used in 2p coins was harder than pure copper.



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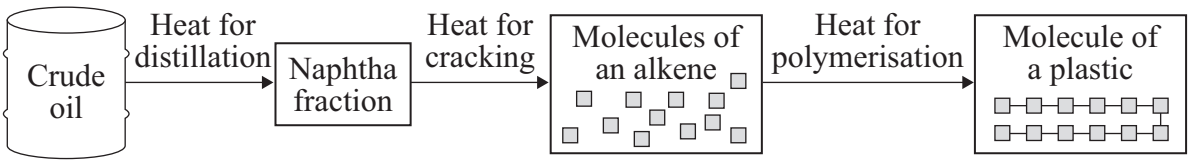
(2 marks)

6

Turn over ▶

Areas outside the box will not be scanned for marking

6 To make a plastic, such as poly(ethene), from crude oil involves many processes.



6 (a) Describe how crude oil is separated into fractions.

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.....

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(2 marks)

6 (b) Ethene is produced by cracking the hydrocarbons in the naphtha fraction.

6 (b) (i) Balance the symbol equation for this reaction.

$$\underset{\text{decane}}{C_{10}H_{22}} \rightarrow \underset{\text{butane}}{C_4H_{10}} + \underset{\text{ethene}}{C_2H_4}$$

(1 mark)

6 (b) (ii) Describe how cracking is carried out.

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(2 marks)

Areas outside the box will not be scanned for marking

6 (c) Alkanes, such as butane (C_4H_{10}), do **not** form polymers.

Alkenes, such as ethene (C_2H_4), do form polymers.

Explain these statements.

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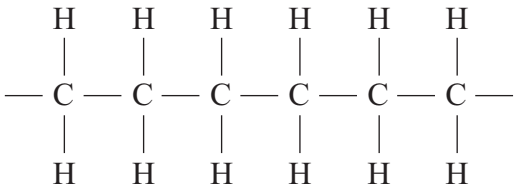
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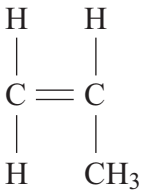
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(2 marks)

6 (d) Ethene molecules form the polymer poly(ethene). One molecule in poly(ethene) will contain thousands of carbon atoms. The diagram represents part of a poly(ethene) molecule.



Propene molecules form the polymer poly(propene).



Propene molecule

Draw a diagram to represent part of a poly(propene) molecule.

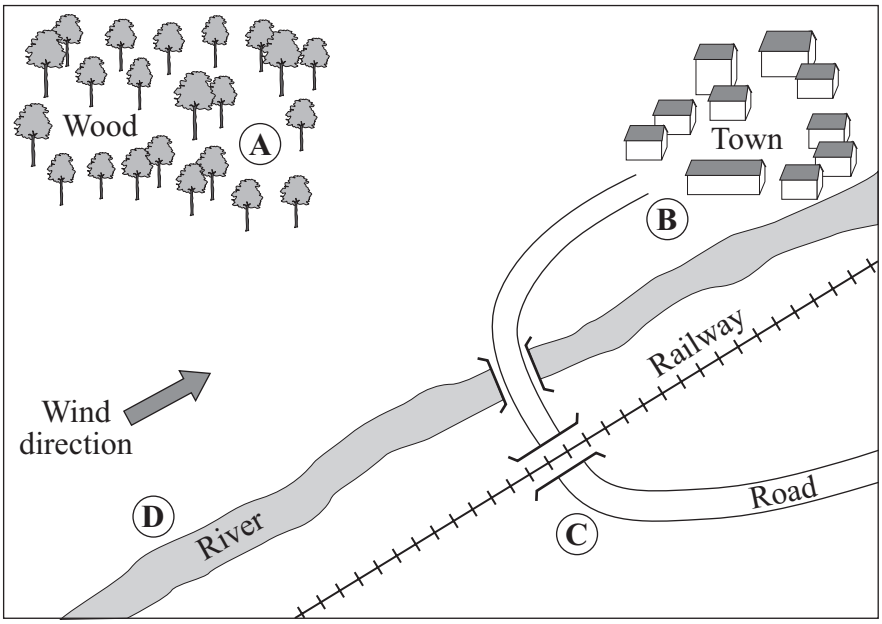
(2 marks)

9

Turn over ▶

Areas outside the box will not be scanned for marking

7 A company wants to extract limestone from an area of natural beauty. The Government has granted permission for the company to take and analyse samples of limestone. The company selects four sites, **A**, **B**, **C** and **D**, within the area and takes four samples from each site.



7 (a) The limestone is analysed by:

- heating 5 g of each sample for 30 minutes
- allowing the sample to cool in a dry, argon atmosphere
- weighing the solid remaining

The table shows the company's results.

Site	Mass of solid remaining in g			
	Sample 1	**Sample 2**	**Sample 3**	**Sample 4**
A	3.15	3.10	3.20	3.19
B	3.25	3.21	3.24	3.26
C	2.85	2.95	2.92	3.00
D	2.98	2.88	2.92	2.82

Limestone is a rock containing calcium carbonate, $CaCO_3$
If the limestone is pure calcium carbonate then the mass of solid remaining would be 2.80 g.

Why does the mass of limestone decrease when it is heated?

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

7 (b) Suggest and explain why the solid remaining was cooled in a dry, argon atmosphere.

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(2 marks)

7 (c) Which site, **A**, **B**, **C** or **D**, would you choose for extracting limestone?

Give the advantages **and** disadvantages for your chosen site.

You must explain why you chose this site.

My chosen site is ☐ .

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(4 marks)

7

END OF QUESTIONS

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Version : 09/03/2010



General Certificate of Secondary Education

Science B 4462 / Chemistry 4411

CHY1H Unit Chemistry 1

Mark Scheme

2010 examination – January series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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

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Dr Michael Cresswell Director General

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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CHY1H

Question 1

question	answers	extra information	mark
1(a)(i)	(yes as it) has the lowest / least (%)	ignore no accept it is only 6.6(%) accept any correct comparisons	1
1(a)(ii)	(no as it) any **one** from: • is second lowest • is 'medium' • is (only) third highest • depends on which oil it is compared with	ignore yes ignore it is only 29.3% accept neither high or low accept not the highest accept any correct comparison accept it has more mono – unsaturated fat	1
1(b)	(test) add bromine / iodine (solution) (result) turns colourless / decolourises	ignore bromide / iodide ignore colours ignore clear ignore changes colour	1 1
1(c)(i)	increase(s) / gets higher	ignore boiling point	1
1(c)(ii)	would increase the saturated (fat) **or** reduce the unsaturated (fat) saturated (fat) is not / less healthy **or** unsaturated (fat) is healthy	idea of increase is required idea of reduction is required accept hydrogenated (fat) is not / less healthy accept bad for you **or** causes heart disease accept good for you eg it would not make it healthier = **0** marks it would not make it healthier because it is saturated(fat) = **2** marks	1 1
Total			**7**

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CHY1H

Question 2

question	answers	extra information	mark
2(a)(i)	any **one** from: • contain metals / filaments / wires • contain other / toxic chemicals / materials • different type of glass	ignore contamination without explanation accept named metal(s) accept named chemical(s) / material(s) accept glass would not melt ignore thicker / thinner glass	1
2(a)(ii)	any **one** from: • (glass bottles are) recycled • need to be more expensive glass **or** strong / thicker / different glass (to be reused) • damaged / weaker (with reuse) • need to be cleaned / transported • different sizes / shapes / colours • no refunds paid	 accept made to be used only once accept glass bottles are made of readily available materials **or** thin / cheap glass accept need to be sorted	1
2(a)(iii)	any **two** from: • low / less energy / heat or lower temperature needed • low / less fuel burned • no (carbon dioxide) from carbonate(s)	allow converse arguments ignore no energy without explanation ignore no fuel without explanation accept less fuel for extraction / transportation of raw materials accept name(s) of this carbonate(s)	2
2(b)(i)	46		1

Question 2 continues on the next page…

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CHY1H

Question 2 continued

question	answers	extra information	mark
2(b)(ii)	any **one** from: • (more) imported (as wine bottles) • not much green glass made in the UK • not a high demand (for green glass)	accept come from / made in other countries **or** made elsewhere	1
2(b)(iii)	any **two** from: • more (clear) glass is produced (64%) than recycled (40%) • (clear) glass going to landfill • (more) raw materials needed / extracted / quarried • (more) heat / energy / fuel would be needed • (more) carbon dioxide produced	accept not enough (clear) glass is recycled allow 'thrown away' ignore they will run out accept high carbon footprint / carbon emissions **or** global warming	2
Total			**8**

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Question 3

question	answers	extra information	mark
3(a)	(thought to cause) global warming / green house (effect) / climate change	ignore other consequences of global warming do **not** accept acid rain / ozone layer / global dimming	1
3(b)	any **three** from: • replant trees / renewable / sustainable • carbon (dioxide) used by trees / photosynthesis • it is a (continuous / carbon) cycle **or** carbon (dioxide) goes back into the air • no new carbon (dioxide) is produced **or** no locked up carbon (dioxide) is released **or** the carbon (dioxide) was absorbed millions of years ago	 ignore reusable accept trees absorb carbon (dioxide) as they grow ignore respiration accept burning wood is carbon neutral for the **second** and **third** bullet points: accept trees use carbon dioxide which is released when (trees / wood are / is) burnt for **2** marks	3
Total			**4**

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Question 4

question	answers	extra information	mark
4(a)	no / insufficient evidence / proof / explanation	accept there were other theories such as a land bridge / solid crust	1
4(b)	(continental / tectonic) plates move any **one** from: • (caused by) convection currents (in the mantle) • (driven by) heat (energy) released by radioactive processes / decay • sudden (movement) / vibrations		1 1
4(c)	any **one** from: • do not know / see / able to detect / measure what is happening <u>below the Earth's crust</u> • build up of pressure between plates is randomly released	 ignore cannot measure movement of plates / unpredictable accept (movement) is random / no pattern	1
Total			**4**

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Question 5

question	answers	extra information	mark
5(a)(i)	sulfur dioxide (forms) acid rain	allow sulfur oxide accept acidic lakes / seas ignore consequences do **not** accept global warming / global dimming / ozone layer	1 1
5(a)(ii)	electrolysis	allow phonetic spelling ignore electroplating	1
5(b)(i)	alloyed / mixed with other metals / elements / atoms / zinc / tin	allow combined / added ignore make it impure do **not** allow reacted / bonded / joined	1
5(b)(ii)	(in the pure copper) copper / metal / atoms / layers able to slide over each other zinc / tin / other (atoms) change the structure / disrupt pattern / layers **or** zinc / tin (atoms) are a different size	accept zinc / tin / other (atoms) prevent (copper) atoms / layers sliding over each other ignore different shapes	1 1
Total			**6**

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Question 6

question	answers	extra information	mark
6(a)	vaporise / evaporate different condensing points / temperatures	allow boil for vaporise accept condense at different levels ignore different size molecules or different densities mention of cracking = max **1** allow boils at different temperatures and condenses for **2** marks if no other marks awarded allow fractional distillation for **1** mark	1 1
6(b)(i)	3 (C_2H_4)	accept +C_4H_8	1
6(b)(ii)	(decane / naphtha / hydrocarbon) vaporise / evaporate (passed over) a catalyst / alumina / porous pot	allow crude oil allow boil for vaporise ignore other names of catalysts	1 1
6(c)	any **two** from: • alkanes / butane (molecules) do not have a (carbon carbon) double bond / are saturated / have (carbon carbon) single bonds • alkenes / ethene (molecules) have (carbon carbon) double bonds **or** are unsaturated • alkenes / ethene molecules are able to bond to other molecules	'they' must be clarified	2
6(d)	single bonds between carbon atoms the $–CH_3$ group appears on each pair of carbons on the 'chain'	— C – C — NB any double bonds = **0** marks	1 1
Total			**9**

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CHY1H

Question 7

question	answers	extra information	mark
7(a)	gas / carbon dioxide / CO_2 (produced / released)	ignore how gas is formed	1
7(b)	any **two** from: • calcium oxide / CaO / quicklime (is the solid) • (calcium oxide) reacts with water **or** carbon dioxide • argon would not react	 accept reacts to form calcium hydroxide / calcium carbonate	2

Question 7 continues on the next page

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CHY1H

Question 7 continued

question	answers	extra information	mark
7(c)	for full marks: candidates should consider and explain **four** of the following points:	for full marks candidates must have at least **one** advantage and **one** disadvantage allow only one advantage / disadvantage for each point **but** each point could be correctly explained as an advantage **and** a disadvantage for **2** marks ignore issues common to all sites eg scarring the landscape / area of natural beauty ignore comments about sites other than the one chosen unless a comparison is made	max 4
	1 Wood / habitats – • screening / use of wood • damage to habitat		
	2 Town (proximity) - • noise / visual / dust pollution / damage / subsidence	ignore pollution unless explained	
	3 Labour force- • proximity to site (travelling time / use of fuel / carbon footprint)		
	4 River - • pollution due to nearness		
	5 Transport (of materials) – • (nearness to road / railway)		
	6 Quality of limestone – • (best D – C – A – B worst) • amount of waste		
	7 Wind direction – • carries dust, noise, fumes etc towards town • (only B & D are directly downwind of town)		
Total			**7**

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature								

For Examiner's Use

General Certificate of Secondary Education
June 2009

SCIENCE B
Unit Chemistry C1

CHY1H

H

CHEMISTRY
Unit Chemistry C1

Higher Tier

Wednesday 17 June 2009 9.00 am to 9.45 am

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed: 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 45.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice
- In all calculations, show clearly how you work out your answer.

For Examiner's Use			
Question	Mark	Question	Mark
1		3	
2		4	
		5	
		6	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

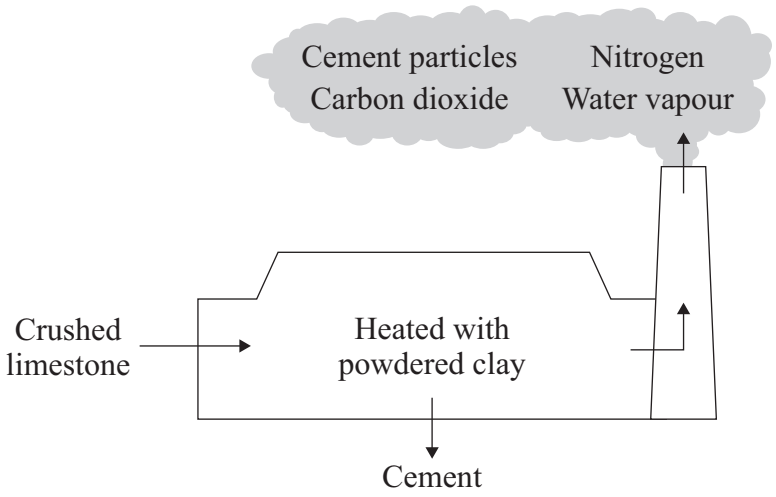
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Answer **all** questions in the spaces provided.

1 A limestone quarry is in an area of natural beauty and near several villages.
The company operating the quarry wants planning permission to build a new cement works in the quarry.

The diagram shows some of the substances used and produced at a cement works.



1 (a) Limestone is mainly calcium carbonate, $CaCO_3$.
Write the correct number in the box to complete each sentence.

1 (a) (i) The formula shows that calcium carbonate, $CaCO_3$,

contains ☐ different elements.

(1 mark)

1 (a) (ii) Calcium carbonate, $CaCO_3$, contains a total number of ☐ atoms.

(1 mark)

Areas outside the box will not be scanned for marking

1 (b) The company wants the new cement works because the nearest cement works is 100 km from the quarry. The company argues that a new cement works sited inside the quarry would reduce carbon dioxide emissions.

Suggest why the new cement works might reduce carbon dioxide emissions.

.....

.....

.....

(1 mark)

1 (c) Residents from the villages near the quarry are concerned that there will be atmospheric pollution from the new cement works.

1 (c) (i) Name and explain how **one** of the emissions from the chimney causes atmospheric pollution.

Name of emission: .....

Explanation: .....

.....

(2 marks)

1 (c) (ii) Suggest what the company could do to reduce this atmospheric pollution.

.....

.....

(1 mark)

6

Turn over for the next question

Areas outside the box will not be scanned for marking

2 (a) Limestone is a hard rock that is used as a building material.
Limestone was used by the Egyptians to make plaster.

Reaction 1 – calcium carbonate, $CaCO_3$, was decomposed by heating limestone

$$CaCO_3 \rightarrow CaO + CO_2$$

Reaction 2 – water was added to the solid produced to make slaked lime

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

Reaction 3 – a mixture of slaked lime and water was used as plaster. After the plaster had set it became even harder with age

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

2 (a) (i) Name the solid formed when calcium carbonate decomposed.

.....

(1 mark)

2 (a) (ii) Use the reactions to explain how the plaster became even harder with age.

.....

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(3 marks)

Areas outside the box will not be scanned for marking

2 (b) A gardener wanted to make a step up to his greenhouse door. He decided to use a mixture of cement and sand to make mortar.

He experimented using mixtures with different cement to sand ratios.

- The mortar mixtures were put in the same sized mould.
- Each mortar mixture was allowed to set hard.
- He then dropped a metal ball from increasing heights until the set mortar cracked.
- He recorded his results in a table.

Volume of sand in cm^3	Volume of cement in cm^3	Height the metal ball dropped to crack the set mortar in cm
800	100	17
700	100	24
600	100	30
500	100	36
400	100	37
300	100	48
200	100	54

2 (b) (i) What is the relationship between the volume of sand and the strength of the mortar?

.....

.....

(1 mark)

2 (b) (ii) The gardener was not sure about some of his results.

Use the results to explain why.

.....

.....

.....

.....

.....

(2 marks)

7

Turn over ▶

Areas outside the box will not be scanned for marking

3 There are many ideas about the formation of the Earth and its atmosphere from a molten ball of rock and minerals.

3 (a) One idea is that the Earth's early atmosphere and average surface temperature were probably like that of Venus today.

The table shows information about the Earth and Venus today.

	Percentage composition of atmosphere	
Name of gas	**Earth today**	**Venus today**
Nitrogen	78	3.5
Oxygen	21	a trace
Argon	0.97	a trace
Carbon dioxide	0.03	96.5
Average surface temperature	20 °C	460 °C

There is a variable amount of water vapour in both atmospheres.

3 (a) (i) How was the Earth's early atmosphere formed?

.....

.....

(1 mark)

3 (a) (ii) The Earth's average surface temperature decreased over time. At what temperature would oceans have started to form?

Temperature = ... °C

(1 mark)

3 (a) (iii) Describe how the evolution of plants changed the Earth's atmosphere.

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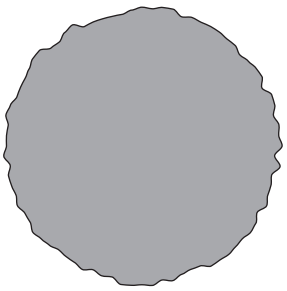
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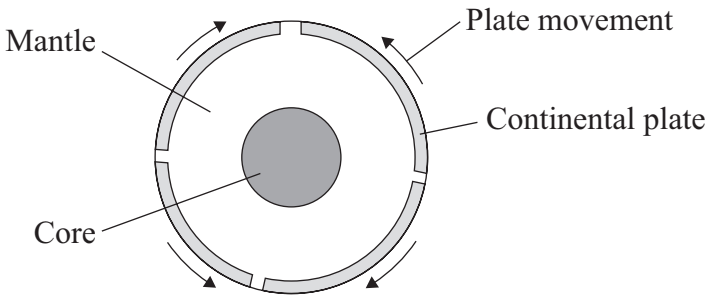
(2 marks)

Areas outside the box will not be scanned for marking

3 (b) Another idea was that the Earth's mountains and continents formed in fixed positions as the molten ball of rock and minerals cooled and wrinkled.



Wegener, in 1915, had the idea that the Earth's crust and the upper part of the mantle had cracked into plates that were able to move. His idea meant that the mountains and continents were not in fixed positions.



3 (b) (i) Give **one** piece of evidence that led to Wegener's idea being accepted.

.....

.....

(1 mark)

3 (b) (ii) Describe what causes the Earth's tectonic plates to move.

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(3 marks)

8

Turn over ▶

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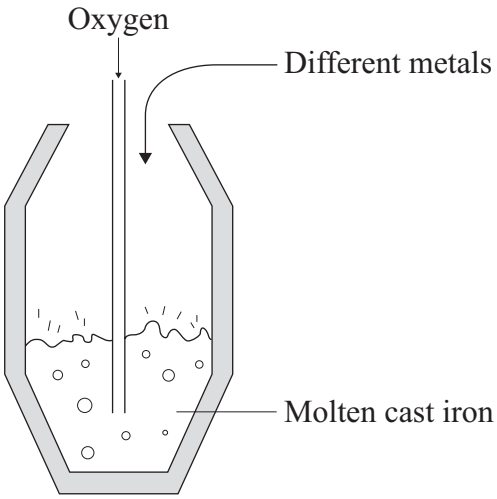
4 The demand for iron and steel is high.

4 (a) Iron that is extracted from its oxide by carbon reduction in a blast furnace is called cast iron. Cast iron contains about 4% carbon. This carbon makes cast iron very brittle.

Carbon steels can be made by the following processes.

- Blowing oxygen into molten cast iron to remove most of the carbon.
- Adding a calculated amount of carbon.

Sometimes different metals may also be added to the molten carbon steels.



4 (a) (i) Suggest how blowing oxygen into molten cast iron removes most of the carbon.

.....

.....

.....

.....

(2 marks)

4 (a) (ii) Why are different metals sometimes added to molten carbon steels?

.....

.....

(1 mark)

Areas outside the box will not be scanned for marking

4 (b) The percentage of iron and steel recycled in the UK has been increasing.

Year	% iron and steel recycled
1998	25
2000	35
2002	42
2004	46
2006	57

The UK government has set targets for the percentage of iron and steel to be recycled. In 2006 the target was exceeded.

Suggest **two** reasons why the UK government wants to encourage recycling of iron and steel.

1 .....

.....

2 .....

.....

(2 marks)

5

Turn over for the next question

Areas outside the box will not be scanned for marking

5 Margarine is manufactured using 'hard' plant oils. A margarine company tested several plant oils to determine their hardness for use in its margarine.

In the test iodine solution was used to find the iodine value. The units are grams of iodine that react with 100 g of oil.

Plant oils with lower iodine values are harder and are less unsaturated.

Plant oil	**Melting point in °C**	**Iodine value**
Coconut	25	10
Palm	35	54
Olive	–6	81
Castor	–18	85
Peanut	3	93
Rapeseed	–10	98
Sunflower	–17	125
Soya bean	–16	130

5 (a) Do the results in the table indicate that there is a relationship between the melting point of a plant oil and its hardness?

Explain your answer.

.....

.....

.....

.....

(2 marks)

Areas outside the box will not be scanned for marking

5 (b) The company stated that some of the plant oils were brown and that this may have affected the results.

Explain why the company considered the colour of plant oils to be a problem with this test.

.....

.....

.....

.....

(2 marks)

5 (c) A consumer group stated that the test should not be carried out by the margarine company but by independent scientists.

Explain why.

.....

.....

.....

.....

(2 marks)

5 (d) The company intends to use sunflower oil to make its margarine.

Explain how the company could process the sunflower oil to make it suitable for the manufacture of margarine.

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.....

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(3 marks)

9

Turn over ▶

Areas outside the box will not be scanned for marking

6 (a) PEX is a material that is used as an alternative to copper for hot water pipes. PEX is made from poly(ethene).

6 (a) (i) Describe how ethene forms poly(ethene).

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(2 marks)

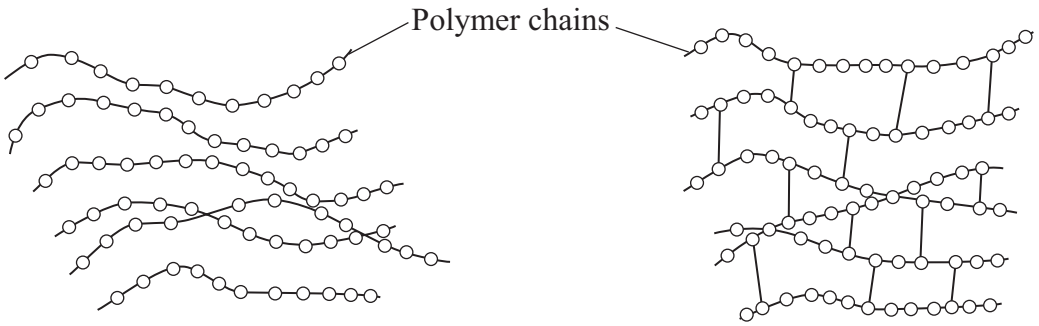
6 (a) (ii) PEX is a shape memory polymer. What property does a shape memory polymer have?

.....

.....

(1 mark)

6 (a) (iii) The simplified structures of poly(ethene) and PEX are shown.



Poly(ethene) **PEX**

Poly(ethene) is a thermoplastic that softens easily when heated.

Suggest and explain how the structure of PEX changes this property.

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(3 marks)

Areas outside the box will not be scanned for marking

6 (b) Copper was considered to be the most suitable material to use for hot water pipes. PEX is now used as an alternative material for hot water pipes.

Copper is extracted from its ore by a series of processes.

1 The low-grade ore is powdered and concentrated.

2 Smelting is carried out in an oxygen flash furnace. This furnace is heated to 1100 °C using a hydrocarbon fuel. The copper ore is blown into the furnace with air, producing impure, molten copper.

3 Oxygen is blown into the impure, molten copper to remove any sulfur. The copper is cast into rectangular slabs.

4 The final purification of copper is done by electrolysis.

PEX is made from crude oil by a series of processes.

1 Fractional distillation

2 Cracking

3 Polymerisation

4 Conversion of poly(ethene) into PEX

Suggest the possible environmental advantages of using PEX instead of copper for hot water pipes.

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(4 marks)

10

END OF QUESTIONS

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit 1 Chemistry

Mark Scheme

2009 examination – June series

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

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Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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CHY1H

Question 1

question	answers	extra information	mark
1(a)(i)	3 / three		1
1(a)(ii)	5 / five		1
1(b)	any **one** from: • less / no transport • less / no (fossil) fuel used	 accept less / no distance ignore references to carbon dioxide / carbon emissions	1
1(c)(i)	carbon dioxide / CO_2 (causes) global warming / climate change / greenhouse gas **or** (cement) particles / smoke (1) (causes) asthma / dust / (global) dimming (1) **or** sulfur dioxide / SO_2 / nitrogen oxides / NO_x (1) (causes) acid rain (1)	for a correct emission explanation must be correct for named emission ignore ozone layer accept breathing problems do **not** accept nitrogen or water vapour for emissions do **not** accept no named emission	1 1

Question 1 continues on the next page…

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CHY1H

Question 1 Continued

question	answers	extra information	mark
1(c)(ii)	absorb / trap / capture / filter / pass through water / scrub / electrostatic attraction	ignore condense / off setting / different fuel	1
Total			**6**

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CHY1H

Question 2

question	answers	extra information	mark
2(a)(i)	calcium oxide / quicklime	allow calcium monoxide do **not** accept calcium dioxide ignore chemical formulae	1
2(a)(ii)	any **three** from: • carbon dioxide / CO_2 • (carbon dioxide) reacts (with the calcium hydroxide / slaked lime / plaster) • limestone / calcium carbonate / $CaCO_3$ forms • water is lost / evaporates	it = plaster allow reaction 3 identified do **not** allow incorrect reaction ignore mixes, unless they state the correct product allow marble / chalk allow moisture ignore dries	3
2(b)(i)	as the amount / volume of sand decreases the strength of the mortar increases	accept as sand decreases the mortar is stronger / harder to crack allow as sand decreases the mortar increases allow converse ignore references to height of metal ball	1

Question 2 continues on the next page…

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CHY1H

Question 2 continued

question	answers	extra information	mark
2(b)(ii)	any **two** from: • 400 / 5th result is anomalous • the interval between the others is similar or the interval is about 6/7 • he has only one set of results	accept two results (36 and 37 / 400 and 500 / 4th and 5th) are almost the same accept result at 400 should be 42 allow the other results fit a pattern / are on a straight line allow he has only done it once ignore reliable	2
Total			**7**

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CHY1H

Question 3

question	answers	extra information	mark
3(a)(i)	(gases from) volcanoes		1
3(a)(ii)	100	allow 99	1
3(a)(iii)	any **two** from: • photosynthesis • carbon dioxide used • oxygen produced	they = plants allow carbon dioxide decreased allow oxygen increased ignore nitrogen / respiration	2
3(b)(i)	any **one** from: • sea floor spreading • periodic measurements between continents • evidence from rocks / fossils on different continents • new mountain ranges	 accept oceanic ridges / magnetic stripes accept continents move a few centimetres each year accept continents fit together accept new islands	1
3(b)(ii)	in the mantle any **two** from: • convection (currents) / movement • radioactivity / radioactive decay / nuclear reactions • releases heat / thermal energy	 do **not** accept movement of the plates accept heat from core	1 2
Total			**8**

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Question 4

question	answers	extra information	mark
4(a)(i)	reacts with carbon / C carbon dioxide / CO_2 / gas is formed / given off	accept burns / oxidises carbon accept carbon monoxide / CO accept correctly balanced equation for **2** marks ignore state symbols	1 1
4(a)(ii)	change / improve properties	accept any specific property accept to make alloys / special steels ignore brittle	1
4(b)	any **two** from: • to conserve ores / iron • to prevent the use of landfills • to conserve energy / fuel • to reduce carbon / carbon dioxide emissions • to meet EU / International targets	 accept ores / iron are non-renewable / non-sustainable allow less quarrying / mining allow reduce waste accept fossil fuels are non-renewable ignore costs / demand	2
Total			**5**

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Question 5

question	answers	extra information	mark
5(a)	yes (there is the general trend) 'as the iodine value increases the melting point decreases' or 'as the hardness decreases the mp decreases' **or** no melting points are in random order / go up and down	accept converse statement do **not** accept boiling point	1
	one specific use of comparative data from the table either showing the trend or an anomaly	can be gained from yes or no answer ignore bp	1
5(b)	the iodine turns colourless		1
	this would be difficult to see (if the oil was dark coloured)	allow similar colour as iodine **or** iodine is brown	1
5(c)	(consumer may think that) the company (scientists) would be biased		1
	consumer more likely to trust independent scientists	allow independent scientists not biased	1
5(d)	add (measured amount of) hydrogen	accept hydrogenation	1
	any **two** from: • (nickel) catalyst • hot / 60°C temperature • hardened	accept add a hard / hydrogenated fat / oil **or** make an emulsion	2
Total			**9**

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CHY1H

Question 6

question	answers	extra information	mark
6(a)(i)	many ethene / molecules / monomers join to form a long hydrocarbon / chain / large molecule	accept double bonds open / break accept addition polymerisation ignore references to ethane correct equation gains **2** marks	1 1
6(a)(ii)	(can be deformed but) return to their original shape (when heated or cooled)	ignore 'it remembers its shape'	1
6(a)(iii)	cross links / extra bonds in PEX molecules / chains in PEX are held in position molecules / chains in PEX unable to slide past each other / move	it = PEX throughout accept inter-molecular bonds ignore inter-molecular forces accept rigid structure	1 1 1

Question 6 continues on the next page…

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CHY1H

Question 6 Continued

question	answers	extra information	mark
6(b)	any **four** from: • less (hydrocarbon) fuels used • less / no electrical energy used • reduce carbon / carbon dioxide emissions • reduce / no pollution by sulfur dioxide / acid rain • continuous process • conserve copper which is running out or only low-grade ores available • reduce the amount of solid waste rock that needs to be disposed • reduce the need to dig large holes (to extract copper ores)	ignore costs / sustainability / non-renewable allow less energy allow no electrolysis allow less global warming allow less / no transportation allow less waste allow less mining	4
Total			**10**

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature								

For Examiner's Use

General Certificate of Secondary Education
January 2009

SCIENCE B
Unit Chemistry C1

CHY1H

H

CHEMISTRY
Unit Chemistry C1

Higher Tier

Thursday 15 January 2009 1.30 pm to 2.15 pm

For this paper you must have:
- a ruler.

You may use a calculator.

Time allowed: 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 45.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice
- In all calculations, show clearly how you work out your answer.

For Examiner's Use			
Question	Mark	Question	Mark
1		3	
2		4	
		5	
		6	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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Areas outside the box will not be scanned for marking

Answer **all** questions in the spaces provided.

1 Water sold in plastic bottles has a high 'carbon cost'.

The 'carbon cost' depends on the amount of carbon dioxide emitted in making and transporting the product.

The more carbon dioxide emitted, the higher the 'carbon cost'.

1 (a) Plastic water bottles are made from a polymer.
The polymer is made from ethene.
Ethene is made by cracking hydrocarbons.

1 (a) (i) Name the polymer made from ethene.

.....

(1 mark)

1 (a) (ii) Ethene can be made by cracking the hydrocarbon pentane, C_5H_{12}.

$$C_5H_{12} \rightarrow C_2H_4 + C_3H_8$$

Explain why there is a 'carbon cost' for the process of cracking a hydrocarbon.

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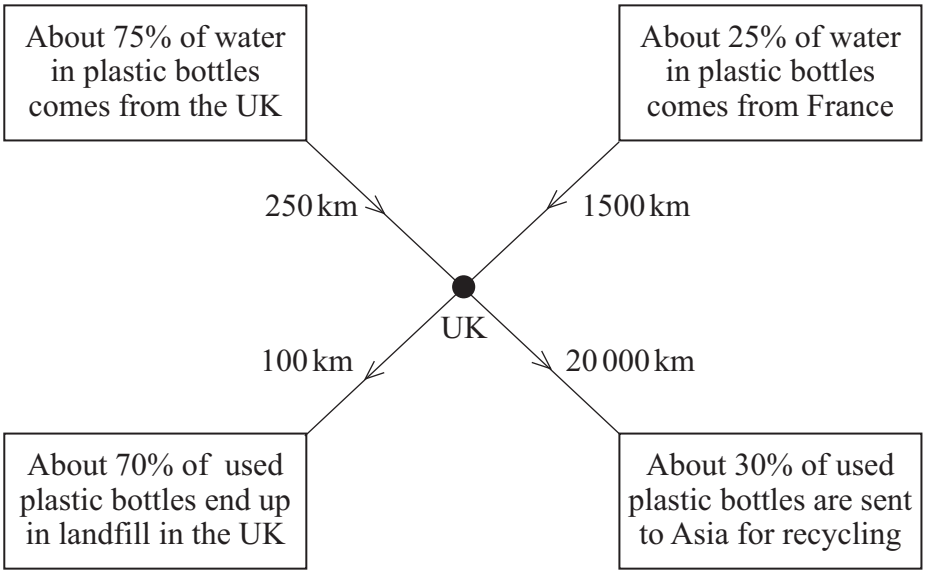
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(2 marks)

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1 (b) The diagram shows information about water sold in plastic bottles in the UK. The diagram also shows the average distances that water and plastic bottles are transported.



Suggest how the high 'carbon cost' of water sold in plastic bottles could be reduced.

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(3 marks)

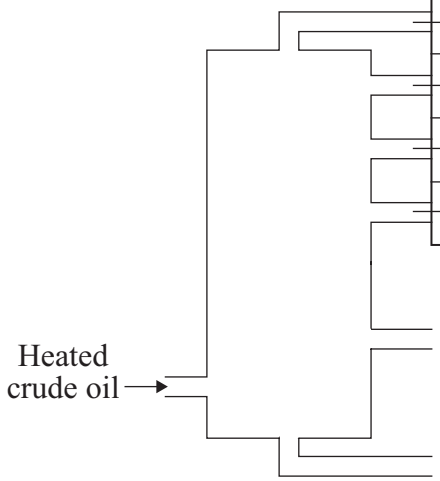
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Turn over for the next question

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2 Crude oil is a resource from which fuels can be separated.

2 (a) The name of the main fuel fractions and one of the hydrocarbons in each fraction are shown in the table.



Main fuel fraction	A hydrocarbon in this fraction	Boiling point of hydrocarbon in °C
Gases	Propane, C_3H_8	−42
Petrol	Octane, C_8H_{18}	126
Paraffin	Dodecane, $C_{12}H_{26}$	216
Diesel	Eicosane, $C_{20}H_{42}$	344

2 (a) (i) How does the number of carbon atoms in a hydrocarbon affect its boiling point?

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(1 mark)

2 (a) (ii) Suggest the lowest temperature to which crude oil needs to be heated to vaporise all the hydrocarbons in the table.

Temperature = ... °C

(1 mark)

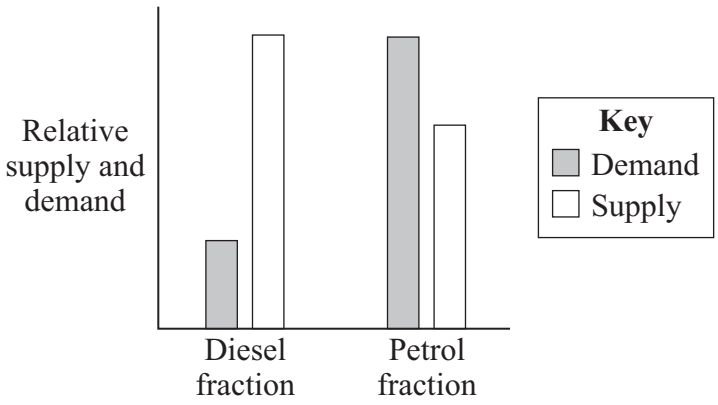
2 (a) (iii) Dodecane boils at 216 °C. At what temperature will dodecane gas condense to liquid?

Temperature = ... °C

(1 mark)

Areas outside the box will not be scanned for marking

2 (b) The bar chart shows the relative supply and demand for the petrol and diesel fractions.



2 (b) (i) How does the relative supply and demand for petrol and diesel fractions cause problems for an oil company?

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(2 marks)

2 (b) (ii) Suggest **one** way an oil company could solve these problems.

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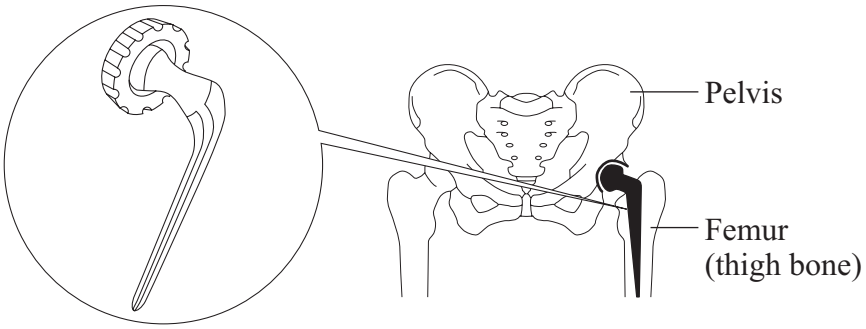
(1 mark)

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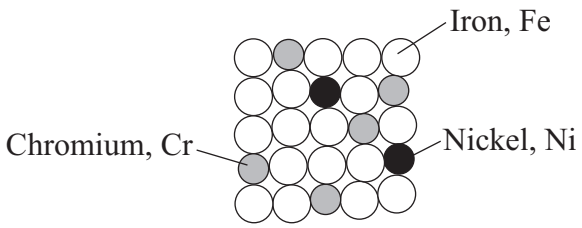
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3 The hip joint between the femur and pelvis sometimes has to be replaced.
Early hip replacement joints were made from stainless steel.



Stainless steel is an alloy of iron, chromium and nickel.

The diagram below represents the particles in stainless steel.



Particle diagram of stainless steel

3 (a) Use the particle diagram to complete the percentages of metals in this stainless steel.

The first one has been done for you.

Element	Percentage (%)
Iron, Fe	72
Chromium, Cr	
Nickel, Ni	

(2 marks)

Areas outside the box will not be scanned for marking

3 (b) Pure iron is a relatively soft, metallic element.

3 (b) (i) Why is iron described as an *element*?

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(1 mark)

3 (b) (ii) Suggest why pure iron would **not** be suitable for a hip replacement joint.

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(1 mark)

3 (b) (iii) Use the particle diagram to help you to explain why stainless steel is harder than pure iron.

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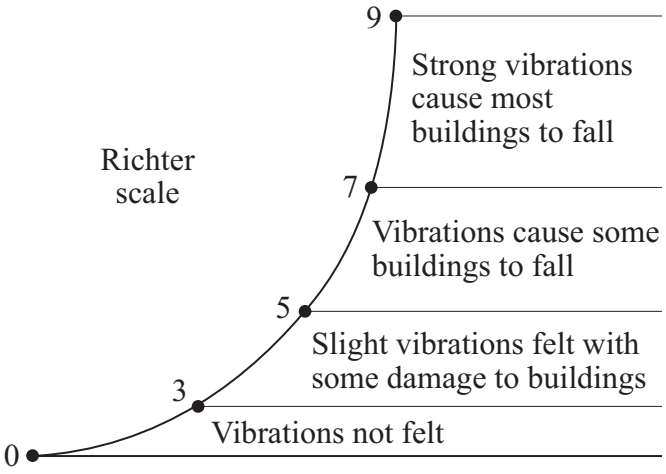
(2 marks)

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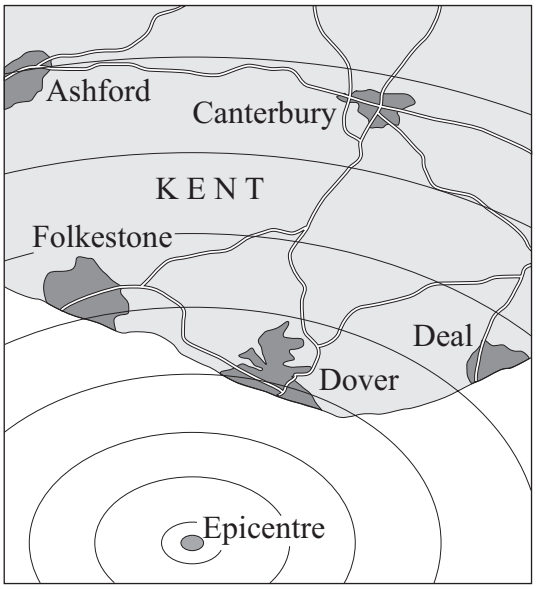
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4 In 1935 C.F. Richter designed a scale for comparing the size of earthquakes.



A newspaper reported that an earthquake off the coast of Kent had caused plaster to come down from ceilings, house tiles to loosen and church bells to ring.



The epicentre is the place on the surface of the Earth directly above where the earthquake occurs.

Areas outside the box will not be scanned for marking

4 (a) Suggest why the earthquake in Kent was reported and why most earthquakes in the UK are **not** reported.

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(2 marks)

4 (b) Explain how earthquakes are caused.

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(3 marks)

4 (c) People living in Kent were not warned about this earthquake.

In terms of what is happening within the Earth, explain the problems of trying to predict earthquakes.

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(2 marks)

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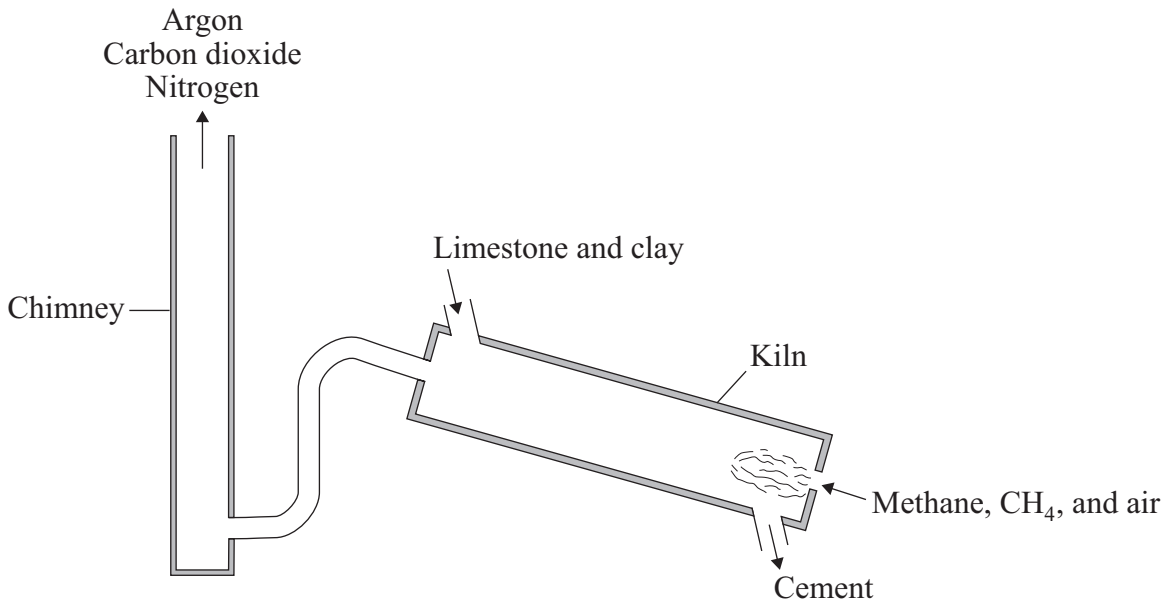
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Areas outside the box will not be scanned for marking

5 Limestone contains calcium carbonate, $CaCO_3$.
At a cement works, limestone is mixed with clay and heated in a kiln.



5 (a) (i) When methane is burned in this process the waste gases contain carbon dioxide and nitrogen.

Explain why.

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(2 marks)

5 (a) (ii) Complete the symbol equation for the thermal decomposition of calcium carbonate.

$CaCO_3 \rightarrow$ ..... + ...

(2 marks)

5 (b) A different fuel is burnt at the cement works.

Suggest **one** reason the company may give for using this different fuel at the cement works.

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(1 mark)

Turn over ▶

Areas outside the box will not be scanned for marking

5 (c) The cement works continue to burn the different fuel.

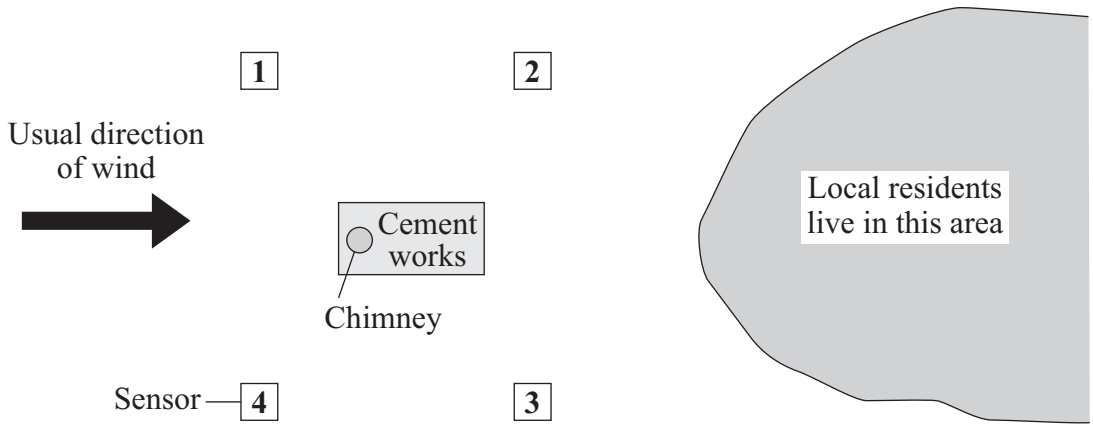
Local residents are concerned because more children are suffering asthma attacks. Residents have also noticed that parked cars are becoming dirty because of smoke particles from the chimney.

The table shows the possible medical risk from smoke particles.

Particle size in mm	Medical effect
Larger than 0.4	No medical risks known
0.3 and smaller	Causes asthma attacks
0.2 and smaller	May cause cancer

It is also recommended that to avoid damage to health, the concentration of any particles should be no higher than 2 parts per million (ppm).

Scientists were brought in to monitor the emissions from the cement work's chimney. They positioned four sensors around the cement works to monitor airborne smoke particles.



These four sensors only detect particle sizes larger than 0.5 mm and measure the concentration of particles in ppm. The scientists reported that the particle sensors showed that the average concentration of particles was 1.8 ppm. The scientists concluded that there was no risk to health.

Areas outside the box will not be scanned for marking

5 (c) (i) Explain why the local residents objected to the positions of the four sensors.

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(2 marks)

5 (c) (ii) What evidence did the scientists use to conclude that there was no risk to health?

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(1 mark)

5 (c) (iii) The local residents were still concerned that there was a risk to health, even though the average concentration of particles was 1.8 ppm.

Explain why.

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(3 marks)

11

Turn over for the next question

Areas outside the box will not be scanned for marking

6 (a) Additives in some crisps include red chilli powder.

Sudan 1 is a bright red dye and is thought to cause cancer. In 2005, it was used to add more colour to a large batch of chilli powder. This batch of chilli powder was used by many food companies. The contaminated foods were removed from sale and destroyed.

6 (a) (i) Suggest why Sudan 1 does **not** have an E number.

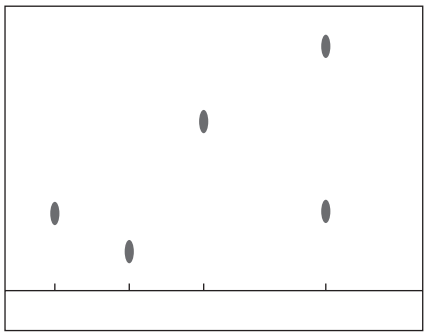
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(1 mark)

6 (a) (ii) A crisp manufacturer tested its chilli powder to check that it did not contain Sudan 1.

The result of the test is shown below.



Explain how this test needs to be modified to show that the chilli powder does **not** contain Sudan 1.

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(2 marks)

Areas outside the box will not be scanned for marking

6 (b) An advert for some crisps claims that they now contain only 30% saturated fat because they are cooked in sunflower oil. The crisp company used bromine water to compare percentage unsaturation of sunflower oil with four other vegetable oils, **A**, **B**, **C** and **D**.

Oil	Volume of bromine water added until the bromine colour just remains (cm^3)				Percentage unsaturation (%)
	Test 1	Test 2	Test 3	Average	
Sunflower	25.4	28.0	27.0	26.8	
A	13.0	14.0	15.0	14.0	35
B	23.2	11.2	24.0	23.6	59
C	19.9	21.1	20.2	20.4	51
D	9.5	8.8	9.3	9.2	23

6 (b) (i) What is the range of percentage unsaturation for oils **A**, **B**, **C** and **D**?

Range = ... %

(1 mark)

6 (b) (ii) Describe and explain what happens to the first drops of bromine water that are added to these oils.

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.....

(2 marks)

6 (b) (iii) The average for oil **B** is given as 23.6 cm^3.

Explain how this average has been calculated.

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.....

(1 mark)

Question 6 continues on the next page

Turn over ▶

Areas outside the box will not be scanned for marking

6 (b) (iv) The results did **not** show that sunflower oil contains 30% saturated fat.

Explain why. (You will need to calculate the percentage unsaturation of sunflower oil.)

.....

.....

.....

.....

(2 marks)

9

END OF QUESTIONS

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit Chemistry 1

Mark Scheme

2009 examination – January series

STEMUP.CO.UK

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Dr Michael Cresswell Director General

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

COMPONENT NUMBER: CHY1H

COMPONENT NAME: Science B / Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
1(a)(i)	polyethene / poly(ethene)	accept polythene / polyethylene	1
1(a)(ii)	needs heat / energy / high temperature / fuel (for cracking) produces carbon dioxide / CO_2	ignore other processes ignore use of CO_2 **or** 'produces carbon'	1 1
1(b)	any **three** from: • use water from local sources **or** water from close to home • recycle bottles in the UK / close to home • (reduction in distance travelled) would reduce CO_2 emitted by transport • use tap water • use glass bottles / waxed cartons / metal bottles • do not put in landfill **or** recycle <u>more</u> • reuse / refill plastic bottles • <u>tax</u> imported water / plastic bottles (to offset carbon cost) • make more / all plastic bottles in UK	answers must be about the reduction of carbon cost accept do not recycle in other countries / Asia accept use of transport with low / no carbon dioxide emissions do **not** accept 'do not use plastic bottles' without an alternative material	3
Total			**6**

COMPONENT NUMBER: CHY1H

COMPONENT NAME: Science B / Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
2(a)(i)	the greater the number (of carbon atoms), the higher its boiling point	do **not** accept hydrocarbons for carbon atoms allow converse allow melting point	1
2(a)(ii)	accept answers in the range 344 to 350		1
2(a)(iii)	216		1
2(b)(i)	**EITHER** shortage of petrol **or** demand for petrol is higher than supply diesel is in excess **or** supply of diesel is higher than demand **OR** petrol low supply **and** diesel high supply (1) petrol high demand **and** diesel low demand (1)	petrol / diesel not specified = max **1** mark	1 1
2(b)(ii)	any **one** from: • <u>use diesel</u> to make petrol • make diesel cheap(er) (than petrol) **or** make petrol more expensive • mix ethanol with petrol	accept crack diesel **or** description of cracking accept lobby the government to reduce the tax on diesel / increase tax on petrol ignore biodiesel	1
Total			**6**

COMPONENT NUMBER: CHY1H

COMPONENT NAME: Science B / Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
3(a)	(Chromium =) 20 (Nickel =) 8	in correct order accept Chromium = 8 **and** Nickel = 20 for **1** mark	1 1
3(b)(i)	(because iron is made up of only) one type of atom		1
3(b)(ii)	not strong	ignore soft / corrosive / flexible accept it rusts / corrodes **or** that it could wear away accept could change shape / bend accept layers / atoms could slide (over each other)	1
3(b)(iii)	has different sized atoms / particles **or** structure is different/distorted / disrupted so it is difficult for layers / atoms / particles to slip / slide (over each other)	 accept not in layers **or** not regular accept layers cannot slip / slide	1 1
Total			**6**

COMPONENT NUMBER: CHY1H

COMPONENT NAME: Science B / Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
4(a)	(Kent reported because) damage was caused **or** it was above 3 (on the Richter scale) (others not reported because) no vibrations / not felt / not noticed	accept description of damage allow below 3 (on Richter scale) ignore no damage	1 1
4(b)	movement of (tectonic) plates any **two** from: • vibration / (shock)waves (in the earth) **or** p and s waves • caused by convection currents (in the mantle) • heat / energy released from radioactive processes	allow collision of plates **or** plates rubbing together **or** plates pushing against each other accept sudden jolts / slips	1 2
4(c)	any **two** from: scientists do not know: • what happens under the crust / mantle / under the surface • where forces / pressures are building up • how to measure these forces / pressures • when these forces / pressures reach their limit	accept anything under the crust accept there is no pattern ignore random / speed of movement	2
Total			**7**

COMPONENT NUMBER: CHY1H

COMPONENT NAME: Science B / Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
5(a)(i)	oxygen / air reacts with carbon / methane (to form carbon dioxide) nitrogen is (unreacted) from the air	accept from the decomposition / reaction of calcium carbonate ignore CO_2 from the air	1 1
5(a)(ii)	CaO CO_2	any order ignore words any incorrect balancing max **1** mark	1 1
5(b)	any **one** from: • more energy / efficient • from a sustainable / renewable resource • produces less / no carbon dioxide / greenhouse gases / global warming • more profit **or** money for local economy • more readily available	it = different fuel allow converse for present fuel ignore no pollution / environmental damage accept fuel is cheap(er)	1
5(c)(i)	any **two** from: • not near where people / residents live • not positioned where concentration of particles was likely to be highest • not positioned downwind	 accept not between cement works and where people live ignore sensors are unsightly	2

Question 5 continues on the next page...

COMPONENT NUMBER: CHY1H

COMPONENT NAME: Science B / Chemistry

STATUS: Final

DATE: January 2009

Question 5 continued...

question	answers	extra information	mark
5(c)(ii)	the average / concentration was 1.8(ppm) **or** the average / concentration was below 2(ppm)	accept 1.8(ppm) is less than 2.0(ppm)	1
5(c)(iii)	any **three** from: • children / people suffering asthma attacks • result was an average • readings (at some (2/3) sensors) could have been higher than 2ppm • sensors did not detect particles below 0.5mm • small particles / particles below 0.5mm / 0.4mm / 0.3mm / 0.2mm could (still) cause cancer / asthma	ignore global dimming **or** cars becoming dirty **or** position of sensors	3
Total			**11**

COMPONENT NUMBER: CHY1H

COMPONENT NAME: Science B / Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
6(a)(i)	Sudan 1 is not a permitted additive	accept it is illegal **or** it is not allowed (in Europe) ignore unsafe	1
6(a)(ii)	the Sudan 1 should have been included to compare against the colourings (in the red chilli powder)		1 1
6(b)(i)	23 to 59	accept 36	1
6(b)(ii)	decolourise **or** (orange to) colourless (because bromine reacts with the) (carbon) double bond	ignore discolours / fades do **not** allow oil decolourises ignore alkenes **or** reference to unsaturation	1 1
6(b)(iii)	any **one** from: • an anomalous result (11.2) / Test 2 • 11.2 / Test 2 is ignored when averaging	accept $\frac{23.2 + 24.0}{2}$ (= 23.6) accept average of tests 1 and 3	1
6(b)(iv)	unsaturation 67% (this means there is) 33% saturated fat	average was less than it should be / only 26.8 cm^3 it should have been 28.0cm^3 to give a percentage of 70%	1 1
Total			**9**