EDEXCEL GCSE CHEMISTRY

CHEMISTRY



EXAM QUESTION PACK

UNIT C1 HIGHER TIER 5CH1H PAPERS

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Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Science

Unit C1: Chemistry in Our World

Higher Tier

Thursday 18 January 2018 – Morning
Time: 1 hour

Paper Reference
5CH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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Questions begin on next page.

Answer ALL questions

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Gases

1 The table shows the composition of the current atmospheres of four planets, **W**, **X**, **Y** and **Z**.
Gases that form less than one per cent of the atmosphere of a planet are not shown.

	percentage of gas in atmosphere of			
	planet W	**planet X**	**planet Y**	**planet Z**
argon	3	2	1	
carbon dioxide	47	96		
helium				6
hydrogen	5			22
nitrogen	33	2	78	
oxygen	12		21	42
sodium				30

One of the planets is Earth.

(a) Which of the planets is Earth?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** planet **W**

☒ **B** planet **X**

☒ **C** planet **Y**

☒ **D** planet **Z**

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(b) The composition of the Earth's early atmosphere was very different from the composition of the Earth's atmosphere today.
One of the planets has an atmosphere similar to that of the Earth's **early** atmosphere.

Explain which planet has an atmosphere similar to that of the Earth's early atmosphere.

(2)

letter of planet .....

explanation .....

.....

.....

(c) (i) Hydrogen, H_2, reacts with oxygen, O_2, to form water, under appropriate conditions.

Write the balanced equation for this reaction.

(2)

.....

(ii) This reaction can be carried out in the laboratory by igniting a mixture of hydrogen and air in a test tube.

Give one observation for this reaction.

(1)

.....

(d) Carbon dioxide is a gas in the atmosphere that helps to keep the Earth warm.

(i) Give the name of another gas in the Earth's atmosphere that helps to keep the Earth warm.

(1)

.....

(ii) State how these gases keep the Earth warm.

(1)

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(Total for Question 1 = 8 marks)

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Rocks

2 Igneous, metamorphic and sedimentary rocks are the three different types of rock in the Earth's crust.

(a) Which of the following are both sedimentary rocks?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** chalk and granite

☒ **B** limestone and chalk

☒ **C** marble and granite

☒ **D** marble and limestone

(b) Igneous rocks can contain different sized crystals.
Rock **S** consists of big crystals and rock **T** consists of small crystals.

Explain, by referring to their different sized crystals, how these two igneous rocks were formed.

(3)

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(c) Mudstone is a sedimentary rock.
Slate is a metamorphic rock formed from mudstone.

Describe the conditions required to form slate from mudstone.

(2)

.....

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(d) Limestone is a natural form of calcium carbonate.
When calcium carbonate is heated strongly, calcium oxide is formed.

Write the balanced equation for this reaction.

(2)

.....

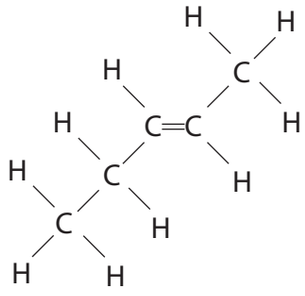
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Alkenes

3 Alkenes are unsaturated hydrocarbons.

The diagram of an alkene molecule is shown.



(a) Explain how the structure of this alkene molecule shows that it is an **unsaturated hydrocarbon**.

(3)

(b) (i) Draw the structure of a molecule of propene, C_3H_6, showing all covalent bonds.

(2)

(ii) Explain what you would **see** if propene is bubbled through bromine water.

(2)

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(c) Propene can be polymerised.

Give the name of the polymer formed when propene is polymerised.

(1)

.....

(d) Complete the balanced equation for the reaction of butene, C_4H_8, with oxygen to form carbon monoxide, CO, and water.

(2)

$C_4H_8 + 4O_2 \rightarrow$ ..... + ...

(Total for Question 3 = 10 marks)

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Acids and electrolysis

4 (a) A solution of sodium chloride can be decomposed using electrolysis.
The products formed at the electrodes are chlorine gas and hydrogen gas.

(i) State the form of energy used to carry out the electrolysis.

(1)

.....

(ii) Describe a test to show that the gas is chlorine.

(2)

.....

.....

.....

.....

(iii) Which of these is made using chlorine?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** bleach

☒ **B** cement

☒ **C** glass

☒ **D** poly(ethene)

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(b) Sodium chloride solution can be produced by the reaction of hydrochloric acid with sodium hydroxide solution.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The reaction of hydrochloric acid with sodium hydroxide is an example of

(1)

☒ **A** combustion

☒ **B** neutralisation

☒ **C** oxidation

☒ **D** thermal decomposition

(ii) Write the balanced equation for the reaction of hydrochloric acid with sodium hydroxide.

(2)

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(c) When water is electrolysed, hydrogen and oxygen gases are formed.
The volumes of hydrogen and oxygen formed are measured at two-minute intervals.
Two experiments are carried out.
In experiment 2 the current used is double the current used in experiment 1.

The results of the two experiments are shown in the table.

time / minutes	experiment 1		experiment 2	
	volume of hydrogen / cm^3	volume of oxygen / cm^3	volume of hydrogen / cm^3	volume of oxygen / cm^3
0	0.0	0.0	0.0	0.0
2	5.0	2.5	10.0	5.0
4	10.0	5.0	20.0	10.0
6	15.0	7.5	30.0	15.0
8	20.0	10.0	40.0	20.0

Use the results to describe the effect of time and current on the volumes of hydrogen and oxygen formed.

(3)

(Total for Question 4 = 10 marks)

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Fuels

5 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

Hydrogen can be used as a fuel in the engines of some vehicles.

An advantage of using hydrogen, rather than petrol, as a fuel for vehicles is that hydrogen

(1)

☒ **A** is not flammable

☒ **B** is a gas

☒ **C** is produced using electricity

☒ **D** produces only water on combustion

(b) Hydrocarbon fuels are obtained from crude oil.
When these fuels are burned sulfur dioxide can be released into the atmosphere.

(i) Explain how sulfur dioxide is formed when the fuels are burned.

(2)

.....

.....

.....

.....

(ii) Sulfur dioxide reacts with rainwater to form sulfurous acid, H_2SO_3.
Sulfurous acid is oxidised by oxygen in the air to form sulfuric acid.

Write the balanced equation for the oxidation of sulfurous acid by oxygen.

(2)

.....

(iii) Give a problem caused by acid rain.

(1)

.....

.....

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*(c) Bioethanol is a biofuel and is produced from plants.
Diesel oil is a fossil fuel obtained from crude oil.
Diesel is commonly used as a fuel for buses.

Evaluate the advantages and disadvantages if bioethanol, rather than diesel, is used as a fuel for buses.

(6)

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(Total for Question 5 = 12 marks)

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Metals

6 (a) Some properties of copper and gold are shown in the table.

metal	cost of 1 kg / £	density / g cm^{-3}	relative strength	resistance to corrosion	ability to conduct electricity
gold	33 000	19.3	low	excellent	excellent
copper	5	8.92	high	good	very good

Very small amounts of gold are used to connect microprocessors and memory chips in some electrical devices, such as mobile phones and computers.

Give **two** reasons why gold is used, rather than copper, in these electrical devices, even though gold is much more expensive than copper.

(2)

reason 1 .....

.....

.....

reason 2 .....

.....

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(b) Metals are often alloyed with other metals to increase their strength.

Explain, in terms of their structures, why gold alloys are stronger than pure gold.

(3)

(c) Most metals are extracted by reduction of compounds in their ores.

State what is meant by the term **reduction**.

(1)

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*(d) The method of extraction of a metal from its ore depends on the reactivity of the metal and, in some cases, on the cost of the extraction process.

The list shows some metals in the reactivity series from the most reactive at the top to the least reactive at the bottom.

most reactive	magnesium
	aluminium
	zinc
	iron
	copper
least reactive	gold

Aluminium, iron and gold are obtained by different methods.

Describe how the method of obtaining these metals is related to their position in the reactivity series and to the cost of the extraction process.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

January 2018

Pearson Edexcel GCSE

In Chemistry (5CH1H)

Paper 01

edexcel

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Acceptable answers	Marks
1 (a)	**C** planet **Y**		1

Question number	Answer	Acceptable answers	Marks
1 (b)	An explanation linking • (planet is) **X (1)** • (its atmosphere contains) large amount of carbon dioxide / {little/ no} oxygen (1)		2

Question number	Answer	Acceptable answers	Marks
1 (c) (i)	$2H_2 + O_2 \rightarrow 2H_2O$ (2) correct formulae only (1) balancing correct formulae (1)	accept multiples	2

Question number	Answer	Acceptable answers	Marks
1 (c) (ii)	Any one from • squeaky pop, popping sound (1) • burns with a colourless flame (1) • colourless liquid on sides of the test tube (1)		1

Question number	Answer	Acceptable answers	Marks
1 (d)(i)	methane / water vapour		1

Question number	Answer	Acceptable answers	Marks
1 (d) (ii)	absorbs/traps heat (radiated from the Earth)	reflects heat back to Earth reject references to ozone layer	1

Total for Question 1 = 8 marks

Question number	Answer	Acceptable answers	Marks
2 (a)	**B** limestone and chalk		1

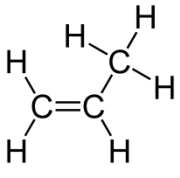
Question number	Answer	Acceptable answers	Marks
2 (b)	An explanation linking any three of the following • {magma/lava/molten rock} cools/solidifies (1) • **S** / large crystals cools slowly (1) • **T** / small crystals cools quickly (1)	reject answers explaining metamorphic or sedimentary processes for all marks	3

Question number	Answer	Acceptable answers	Marks
2 (c)	A description including: • heat (1) • pressure (1)	compressed/squashed/compacted	2

Question number	Answer	Acceptable answers	Marks
2 (d)	$CaCO_3 \rightarrow CaO + CO_2$ (2) reactant only left hand side (1) products only right hand side (1)	correct multiples ignore state symbols correct formulae in an unbalanced equation maximum 1 mark	2

Total for Question 2 = 8 marks

Question number	Answer	Acceptable answers	Marks
3 (a)	An explanation linking the following • contains carbon (atoms) and hydrogen (atoms) (1) • only (1) • contains at least one double bond (1)	reject carbon molecules and hydrogen molecules allow has general formula, C_nH_{2n} (2)	3

Question number	Answer	Acceptable answers	Marks
3 (b) (i)	 (2) one C=C bond in a three consecutive carbon atom molecule (1) rest of structure correct (1)	allow methyl group written as CH_3 ignore bond angles	2

Question number	Answer	Acceptable answers	Marks
3 (b) (ii)	A description including: • the mixture turns from orange to colourless (1) • propene contains C=C / unsaturated (1)		2

Question number	Answer	Acceptable answers	Marks
3 (c)	poly(propene)	ignore any numbers, brackets are not required	1

Question number	Answer	Acceptable answers	Marks
3 (d)	$C_4H_8 + 4\ O_2 \rightarrow$ **4 CO + 4 H_2O** (2) products formulae only (1) balancing of correct formulae (1)	ignore state symbols	2

Total for Question 3 = 10 marks

Question number	Answer	Acceptable answers	Marks
4 (a) (i)	electrical (energy) / electricity / direct (electric) current		1

Question number	Answer	Acceptable answers	Marks
4 (a) (ii)	A description including: • (blue) litmus (paper)(1) • (turns red then) turns white / bleaches (1)	allow UI paper reject further colour changes after bleaching	2

Question number	Answer	Acceptable answers	Marks
4 (a)(iii)	**A** bleach		1

Question number	Answer	Acceptable answers	Marks
4 (b)(i)	**B** neutralisation		1

Question number	Answer	Acceptable answers	Marks
4 (b)(ii)	$HCl + NaOH \rightarrow NaCl + H_2O$ (2) reactants only (1) products only (1)	allow multiples ignore state symbols correct formulae in an unbalanced equation maximum 1 mark	2

Question number	Answer	Acceptable answers	Marks
4 (c)	A description for hydrogen or oxygen or both including any three from • as time increases volume of gas increases (1) • volume of gas is (directly) proportional to time (1) • as current increases volume of gas increases (1) • volume of gas is (directly) proportional to current (1)	as time doubles, the volumes of both gases doubles (2) as current doubles, the volumes of both gases doubles (2)	3

Total for Question 4 = 10 marks

Question number	Answer	Acceptable answers	Marks
5 (a)	**D** produces only water on combustion		1

Question number	Answer	Acceptable answers	Marks
5(b)(i)	An explanation linking • sulfur (impurities in fuel) (1) • (sulfur) burned in **oxygen** (1)		2

Question number	Answer	Acceptable answers	Marks
5(b)(ii)	$2\ H_2SO_3 + O_2 \rightarrow 2\ H_2SO_4$ (2) correct formulae only (1) balancing of correct formulae (1)	allow multiples ignore state symbols	2

Question number	Answer	Acceptable answers	Marks
5 (b) (iii)	Any one from • {harms/kills} {aquatic life/fish} (1) • {harms/kills} {plants/trees} (1) • erodes/damages buildings/statues (1)		1

Question number		Indicative Content	Marks
QWC	*5c	An evaluation to include some of the following points ADVANTAGES OF BIOETHANOL • (the source) is sustainable/renewable / diesel is finite / takes a long time to form crude oil • crops used to make bioethanol can be regrown quickly/takes a long time to form crude oil • use reduces demand on fossil fuels / conserves diesel/crude oil • photosynthesis (in plants) uses up carbon dioxide / carbon dioxide is removed from air when growing crops (which are used in ethanol production) • photosynthesis (in plants) produces oxygen • no net increase in carbon dioxide / carbon neutral • bioethanol does not contain sulfur/does not release sulfur dioxide when burned • bioethanol burns more completely (diesel does not) / burns more efficiently in air with less carbon monoxide / less soot/smoky flame than diesel DISADVANTAGES OF BIOETHANOL • less readily available than diesel • growing plants uses up land / lots of crops needed to generate sufficient fuel to replace diesel • less farmland available for growing food crops • loss of biodiversity/ loss of animal and/or plant habitats • low yield of bioethanol from crops ignore references to cost	6
Level	0	No rewardable content	
1	1 - 2	• a limited description e.g. using bioethanol conserves crude oil deposits • answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	3 - 4	• a simple description e.g. growing plants gives continuous supply of bioethanol but diesel comes from crude oil which is finite • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	5 - 6	• a detailed description e.g. growing plants remove carbon dioxide from the air but lots of crops are needed to make sufficient bioethanol to replace diesel therefore less land to grow food crops • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Question 5 = 12 marks

Question number	Answer	Acceptable answers	Marks
6 (a)	• gold is an excellent conductor/better ability to conduct electricity than copper (1) • gold has a high resistance to corrosion /higher resistance to corrosion than copper (1)		2

Question number	Answer	Acceptable answers	Marks
6 (b)	An explanation linking any three from • in pure gold all the atoms are the same (size) (1) • therefore {layers/rows/sheets} of atoms easily slide over each other (1) • in the gold alloy atoms are different sizes (1) • therefore {layers/rows/sheets} of atoms cannot easily slide over each other (1)	reject the use of the word molecules once only accept ion in place of atom	3

Question number	Answer	Acceptable answers	Marks
6 (c)	loss of oxygen	allow gain of electrons	1

Question Number		Indicative Content	Marks
QWC	***6(d)**	A description to include some of the following points METHODS OF EXTRACTION • gold is found uncombined • iron is extracted by heating with carbon • aluminium is extracted by electrolysis JUSTIFICATION gold • gold is at the bottom of the reactivity series / it is unreactive • it does not combine with other elements in the Earth's crust (so it found as an uncombined metal) • no reaction required to obtain gold iron • iron is in the middle of the reactivity series / it is less reactive than aluminium/ it is more reactive than gold • it is found combined with other elements • can be extracted by heating with carbon • electrolysis can be used • electrolysis is a more expensive process than heating with carbon / heating with carbon is cheaper aluminium • aluminium is near the top of the reactivity series / it is more reactive than iron and gold / it is very reactive • it is found combined with other elements • its compounds are very stable • it cannot be extracted by heating with carbon • electrolysis is a more powerful method of reduction • but electrolysis is expensive due to cost of electricity needed	**6**
Level	**0**	No rewardable content	
1	**1 - 2**	• A limited description of a method of extraction linked to a metal or justification in terms of reactivity or cost • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A simple description of three methods linked to each metal or two methods and justification in terms of reactivity or cost for one of the metals • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• A detailed description to include all three methods of extraction linked to each metal and justification in terms of reactivity for two metals with a reference to cost • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Question 6 = 12 marks

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Science

Unit C1: Chemistry in Our World

Higher Tier

Thursday 18 May 2017 – Morning
Time: 1 hour

Paper Reference
5CH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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Questions begin on next page.

Answer ALL questions

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Carbon dioxide

1 Carbon dioxide dissolves in the water in the Earth's oceans.

(a) Describe how these oceans were originally formed.

(2)

.....

.....

.....

(b) Some rocks are formed from dissolved carbon dioxide.

(i) Describe how this happens.

(2)

.....

.....

.....

.....

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The substance formed in these rocks is

☒ **A** calcium carbonate

☒ **B** sodium chloride

☒ **C** calcium hydroxide

☒ **D** iron oxide

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(c) Iron seeding is the introduction of iron into the ocean.
This stimulates the growth of small plants.

Explain how the growth of these plants affects the amount of carbon dioxide in the atmosphere.

(2)

(d) Carbon dioxide is one of the products of the complete combustion of methane in air.

Write the word equation for this reaction.

(2)

(Total for Question 1 = 9 marks)

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Acids and electrolysis

2 Acids can undergo neutralisation to form salts.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

An acid reacts with a metal oxide to form

☒ **A** a salt + carbon dioxide

☒ **B** a salt + hydrogen

☒ **C** a salt + oxygen

☒ **D** a salt + water

(b) Acids also react with metal carbonates.

The equation for the reaction of calcium carbonate with dilute hydrochloric acid is

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

Describe what you would **see** when solid calcium carbonate reacts with dilute hydrochloric acid.

(2)

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(c) Hydrogen and oxygen are produced by the electrolysis of water, acidified with a small amount of dilute sulfuric acid.

(i) Explain what is meant by **electrolysis**.

(2)

(ii) Describe the test to show that a gas is oxygen.

(2)

(iii) Describe the test to show that a gas is hydrogen.

(2)

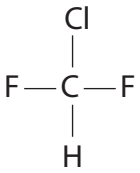
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Organic compounds

3 (a) (i) Methane, CH_4, is a hydrocarbon.

Chlorodifluoromethane can be formed from methane.
A diagram of one molecule of this compound is



Explain whether or not this molecule is a hydrocarbon.

(2)

(ii) Chlorodifluoromethane is a gas.
When it is bubbled through bromine water, the orange colour remains.

State what this shows about the structure of this compound.

(1)

(b) Gases in the atmosphere that trap heat from the Sun are known as 'greenhouse gases'.

(i) Give one possible consequence of an increase in the amount of these gases in the atmosphere.

(1)

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Chlorodifluoromethane is a gas that traps heat from the Sun.

Another gas that traps heat from the Sun is

☒ **A** argon

☒ **B** nitrogen

☒ **C** oxygen

☒ **D** water vapour

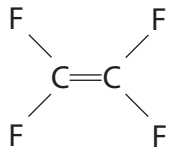
(c) When chlorodifluoromethane, $CHClF_2$, is strongly heated, it decomposes to form tetrafluoroethene, C_2F_4, and hydrogen chloride.

Complete the balanced equation for this reaction.

(2)

$2CHClF_2 \rightarrow$ ..... + ...

(d) The structure of a molecule of tetrafluoroethene is



A sample of this gas was kept in a cylinder under high pressure.
The cylinder was left unused for a long time.

When the cylinder was opened no gas remained.
Instead it contained a slippery, waxy, white solid.

(i) State the type of reaction that occurred when tetrafluoroethene gas formed the solid.

(1)

.....

(ii) Deduce the name of the solid formed.

(1)

.....

(Total for Question 3 = 9 marks)

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Metals

4 (a) Most metals are extracted from rocks found in the Earth's crust.

(i) Iron is extracted from iron oxide.
The iron oxide, Fe_2O_3, is heated with carbon.

Complete the balancing of the equation for this reaction by putting numbers in the spaces provided.

(2)

$$2Fe_2O_3 + 3C \rightarrow \ldots\ldots\ldots Fe + \ldots\ldots\ldots CO_2$$

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

When the iron oxide reacts with carbon to form iron and carbon dioxide

☒ **A** carbon is reduced and iron oxide is reduced

☒ **B** carbon is oxidised and iron oxide is oxidised

☒ **C** carbon is reduced and iron oxide is oxidised

☒ **D** carbon is oxidised and iron oxide is reduced

(b) Gold is used to make some items of jewellery.

Gold alloys, rather than pure gold, are often used in items of jewellery.

The table shows some information about the properties of two types of gold.

type of gold / carats	relative strength	cost / £ / g
18	medium	16
24	low	22

Use the information in the table to explain why gold alloys, rather than pure gold, are often used in items of jewellery.

(2)

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(c) The table shows four metals in the order in which they appear in the reactivity series, from the most to the least reactive.

The methods of extraction for three of these metals from their ores are given.

metal	method of extraction
sodium	
aluminium	electrolysis
iron	heating with carbon
gold	found uncombined

(i) Suggest the method used to extract sodium from its ore.

(1)

.....

(ii) Explain why this method has to be used.

(2)

.....

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.....

.....

(d) Shape memory alloy tubes can be used in modern surgery as stents to repair damaged blood vessels.

Explain what is meant by a **shape memory alloy.**

(2)

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(Total for Question 4 = 10 marks)

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Fuels

5 Crude oil is fractionally distilled to produce fractions.
These fractions have many uses.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The fraction least likely to be used as a fuel is

☒ **A** bitumen

☒ **B** diesel oil

☒ **C** kerosene

☒ **D** gases

(b) Some of the fractions from crude oil are cracked.

(i) Describe what is meant by **cracking**.

(2)

.....

.....

.....

.....

(ii) When butane is cracked, a number of different hydrocarbons are formed.

Draw the structure of a molecule of one of these hydrocarbons, showing all bonds.

(2)

*(c) The following passage gives some information about hydrogen used as fuel in cars.

> The fuel used in some cars is hydrogen. It is stored in pressurised tanks underneath the cars. The processes used to produce the hydrogen and pressurise it may require the use of fossil fuels.
>
> The company expects sales of these cars to increase as more hydrogen filling stations are built.

Use your knowledge of hydrogen and petrol to explain the advantages and disadvantages of using hydrogen rather than petrol as the fuel in cars.

(6)

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(Total for Question 5 = 11 marks)

Rocks

6 Calcium carbonate is an important raw material in the chemical industry.

(a) Which of these is not made in a process using calcium carbonate?

Put a cross (☒) in the box next to your answer.

(1)

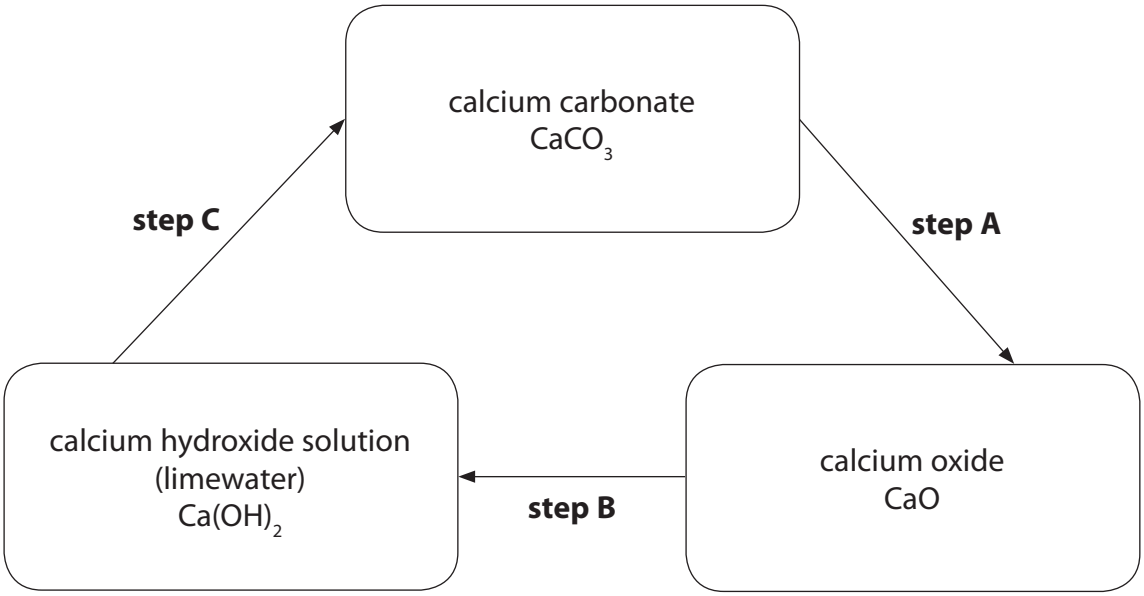
☒ **A** cement

☒ **B** concrete

☒ **C** glass

☒ **D** PVC

(b) The diagram shows reactions of some calcium compounds.



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(i) In step **A**, a known mass of calcium carbonate is heated in order to obtain calcium oxide.
The mass of the calcium oxide formed is found.

Suggest how to continue the experiment to prove that the reaction is complete.

(3)

(ii) The reaction in step **C** is the one that occurs in the test for carbon dioxide.

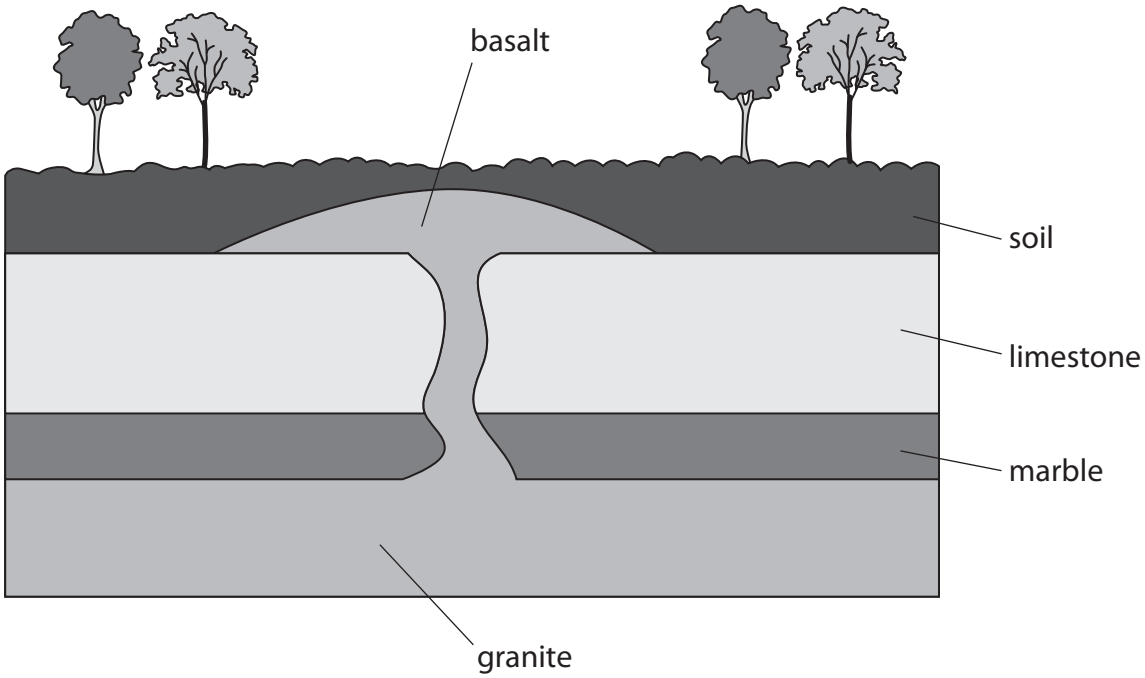
Write the balanced equation for the reaction of calcium hydroxide with carbon dioxide.

(2)

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*(c) The diagram shows where the following rocks can be formed in the Earth's crust.

limestone, a sedimentary rock
marble, a metamorphic rock
basalt, an igneous rock consisting of small crystals
granite, an igneous rock consisting of large crystals



Explain how these rocks were formed.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCSE

In Chemistry (5CH1H) Paper 1H

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Summer 2017
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General Marking Guidance

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Acceptable answers	Marks
1 (a)	A description to include any two of • {water vapour / steam} (1) • the Earth cooled (1) • {water vapour / steam} condensed / changed to liquid (1)		**(2)**

Question number	Answer	Acceptable answers	Marks
1 (b) (i)	A description to include any two of • marine organisms /sea creatures absorb/take in carbon dioxide (1) • (and use the carbon dioxide) to form shells /calcium carbonate (1) • (shells) form **sedimentary** (rocks) (1)	reject incorrect references to metamorphic (heat and pressure/ igneous rock formation allow limestone/chalk	**(2)**

Question number	Answer	Marks
1 (b) (ii)	**A** calcium carbonate **The only correct answer is A** **B** is not correct because sodium chloride is not formed from dissolved carbon dioxide **C** is not correct because calcium hydroxide is not formed from dissolved carbon dioxide **D** is not correct because iron oxide is not formed from dissolved carbon dioxide	**(1)**

Question number	Answer	Acceptable answers	Marks
1 (c)	An explanation linking • plants photosynthesise (1) **M1** • so reducing/decreasing/ lowering carbon dioxide levels (1)	allow plants take in carbon dioxide and release oxygen ignore reference to respiration/ breathing for **M1** Ignore remove must reference to lowering/reduction	**(2)**

Question number	Answer	Acceptable answers	Marks
1 (d)	methane + oxygen → carbon dioxide + water LHS (1) RHS (1)	ignore air allow water vapour ignore heat/energy allow reactants on LHS and products on RHS in either order allow $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ (2) ignore state symbols allow = for →	**(2)**

(Total for question 1 = 9 marks)

Question number	Answer	Marks
2 (a)	**D** a salt + water **The only correct answer is D** **A** is not correct because a metal oxide reacting with acid would not produce carbon dioxide as one of the products **B** is not correct because a metal oxide reacting with acid would not produce hydrogen as one of the products **C** is not correct because a metal oxide reacting with acid would not produce oxygen as one of the products	**(1)**

Question number	Answer	Acceptable answers	Marks
2 (b)	A description to include • effervesces/fizzes/bubbles (1) • (solid) disappears / (colourless) solution (formed) (1)	ignore gas/carbon dioxide evolved /steam/smoke reject ppt /any colour allow (solid) dissolves/decreases in size /clear Ignore disintegrate/breaks up	**(2)**

Question number	Answer	Acceptable answers	Marks
2 (c) (i)	An explanation including • decomposing / breaking down of (compounds/ substance/ electrolyte) (1) • direct current / d.c. supply / using electrical energy / electricity (1) (mark independently)	allow splitting up/breaking up ignore separate reject thermal decomposition reject breaking down of elements/atoms/molecules/ metals/bonds reject a.c. supply	**(2)**

Question number	Answer	Acceptable answers	Marks
2 (c) (ii)	A description to include • a glowing splint (1) **M1** • relights (1) **M2** **M2** dependent on **M1**	allow smouldering/ embering splint (1) ignore blown out reject unlit splint reject other tests lighted splint burns brighter (2)	**(2)**

Question number	Answer	Acceptable answers	Marks
2 (c) (iii)	A description including the following: • lighted/lit splint / ignite gas (1) **M1** • gas burns / with (squeaky) pop (if air present) (1) **M2** **M2** dependent on **M1**	allow flame	**(2)**

(Total for question 2 = 9 marks)

Question number	Answer	Acceptable answers	Marks
3 (a) (i)	An explanation linking **EITHER** • no because a hydrocarbon contains carbon and hydrogen (1) • only (1) **OR** • no because this molecule contains chlorine/ fluorine/ other elements (1) • as well as carbon and hydrogen (1)	reject mixture for the 1st mark reject reference to carbon or hydrogen molecules allow H and C for 1st mark ignore fluoride/chloride/ substance(s) allow Cl / F allow H and C for 2nd mark reject reference to carbon or hydrogen molecules	**(2)**

Question number	Answer	Acceptable answers	Marks
3 (a) (ii)	molecule {is saturated/ has no double (or multiple) bond}	allow has only single bonds ignore 'spare bonds' ignore it is an alkane / not an alkene ignore reference to number of hydrogen atoms attached	**(1)**

Question number	Answer	Acceptable answers	Marks
3 (b) (i)	(Earth's) temperature may rise/ temperature increases / may get warmer (1)	reject references to ozone layer ignore pollution allow global warming/climate change allow melting of ice/ sea levels rise / increase in flooding allow alteration in areas available for crop growing/damage wildlife habitats allow more extreme weather conditions likely	**(1)**

Question number	Answer	Marks
3 (b) (ii)	**D** water vapour **The only correct answer is D** **A** is not correct because argon is not a greenhouse gas **B** is not correct because nitrogen is not a greenhouse gas **C** is not correct because oxygen is not a greenhouse gas	**(1)**

Question number	Answer	Acceptable answers	Marks
3 (c)	$(2CHClF_2) \rightarrow \mathbf{C_2F_4} + 2\mathbf{HCl}$ (1) formulae (1) balancing correct formulae (1)	ignore state symbols	**(2)**

Question number	Answer	Acceptable answers	Marks
3 (d) (i)	polymerisation / addition /addition polymerisation		**(1)**

Question number	Answer	Acceptable answers	Marks
3 (d) (ii)	poly(tetrafluoroethene)/ PTFE (1)	allow Teflon™ allow polytetrafluoroethene reject poly(tetrafluoroeth**a**ne)	**(1)**

(Total for question 3 = 9 marks)

Question number	Answer	Acceptable answers	Marks
4 (a) (i)	$(2Fe_2O_3)$ + (3 C) → **4** (Fe) + **3** (CO_2) **4** (1) **3** (1)		**(2)**

Question number	Answer	Marks
4 (a) (ii)	**D carbon is oxidised and iron oxide is reduced** **The only correct answer is D** **A** is not correct because carbon is not reduced **B** is not correct because iron oxide is not oxidised **C** is not correct because neither is carbon reduced nor is iron oxide oxidised	**(1)**

Question number	Answer	Acceptable answers	Marks
4 (b)	An explanation linking **two** from • 24-carat is pure gold / 18-carat is the alloy (1) • alloy is stronger / less easily damaged/worn away/ bent out of shape/ less malleable /withstand forces ORA (1) • alloy is cheaper / has lower cost ORA(1)	allow harder	**(2)**

Question number	Answer	Acceptable answers	Marks
4 (c) (i)	electrolysis		**(1)**

Question number	Answer	Acceptable answers	Marks
4 (c) (ii)	an explanation to include two of the following • sodium compounds are very stable / sodium is a very reactive metal (1) • electrolysis is a strong / powerful method (of reduction extraction) (1) • aluminium is extracted by electrolysis so sodium must be extracted by electrolysis / sodium needs more energy to be reduced (1) • carbon does not react with sodium compounds (1) **ignore answer to part (i)**	allow sodium is more reactive than /higher in the reactivity series than aluminium (1) allow sodium is more reactive than/higher in the reactivity series than carbon (1)	**(2)**

Question number	Answer	Acceptable answers	Marks
4 (d)	An explanation including • (an alloy that) returns to its original shape (1) • with a change of temperature / with an electric current (1)	 ignore remembers allow 'normal' shape allow when heated/cooled	**(2)**

(Total for question 4 = 10 marks)

Question number	Answer	Marks
5 (a)	**A** bitumen **The only correct answer is A** **B** is not correct because diesel oil is likely to be used as a fuel and more likely to be used as a fuel when compared to bitumen **C** is not correct because kerosene is likely to be used as a fuel and more likely to be used as a fuel when compared to bitumen **D** is not correct because gases are likely to be used as a fuel and more likely to be used as a fuel when compared to bitumen	**(1)**

Question number	Answer	Acceptable answers	Marks
5 (b) (i)	A description to include • (thermal) decomposition / breaking down /splitting (of long/large hydrocarbons molecules) (1) • to form {shorter molecules / alkene(s)} (1)	fractional distillation = 0 ignore 'chains of molecules/hydrocarbons' allow smaller molecules /shorter hydrocarbons/ shorter chains / more useful	**(2)**

Question number	Answer	Acceptable answers	Marks
5 (b) (ii)	Any one of the correct structural formula showing all covalent bonds of • methane, CH_4 • ethene, $H_2C=CH_2$ • ethane, CH_3CH_3 • propene, $CH_3CH=CH_2$ • propane, $CH_3CH_2CH_3$ • butene, $CH_2=CHCH_2CH_3$ / $CH_3CH=CHCH_3$ a structure with the correct number of hydrogen and carbon atoms shown (1) **M1** rest of structure correct showing all covalent bonds conditional on the 1st mark (1) **M2**	ignore names allow correct molecular formula for **M1** allow CH_3- for methyl and CH_3CH_2- for ethyl groups for **M2**	**(2)**

Question Number		Indicative Content	Mark
QWC	*5c	An explanation to include some of the following points **advantages** • only water is produced (as waste) • water is harmless/non-toxic / water from combustion of hydrogen has an insignificant effect on global warming • no carbon dioxide emitted • less greenhouse gas emissions/less global warming • no carbon monoxide emitted • carbon monoxide is toxic • no oxides of nitrogen/sulfur dioxide emitted /does not release toxic gases • does not contribute to acid rain • water/hydrogen is renewable/sustainable • plentiful supply of water/raw material • the product of combustion is the source of more hydrogen fuel • raw material/water for fuel is renewable/sustainable **disadvantages** • hydrogen more difficult to store/transport • needs storing/transporting under pressure/in heavy tanks • hydrogen may be produced by electrolysis • using electricity made via fossil fuels/which is costly • carbon dioxide will be produced in the manufacture, transportation and storage of hydrogen • more greenhouse gas emissions/more global warming • hydrogen less available on market • few hydrogen filling-stations/costly to convert existing stations • hydrogen car more expensive to run • cars made to use hydrogen are more expensive than cars made to use petrol • hydrogen is a gas/explosive (when mixed with oxygen and ignited) • leaks are difficult to detect	**(6)**

Level	**0**	No rewardable content
1	**1 - 2**	• A limited explanation of an advantage or a disadvantage of hydrogen OR an advantage and a disadvantage with no explanation e.g. no carbon dioxide emitted, only water produced • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	• A simple explanation of an advantage/disadvantage and an identification of an advantage/disadvantage OR identification of three advantages/disadvantages • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• A detailed explanation of at least an advantage and a disadvantage • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

(Total for question 5 = 11 marks)

Question number	Answer	Marks
6 (a)	**D PVC** **The only correct answer is D** **A** is not correct because the process of making cement does use calcium carbonate **B** is not correct because the process of making concrete does use calcium carbonate **C** is not correct because the process of making glass does use calcium carbonate	**(1)**

Question number	Answer	Acceptable answers	Marks
6 (b) (i)	A suggestion to include • (re)heat (the solid) (1) • re-weigh (solid) /re-determine mass of solid / pass any gas through limewater (1) • mass after heating remains the same/constant mass / limewater remains colourless (1)	heat (solid) to constant mass (3)	**(3)**

Question number	Answer	Acceptable answers	Marks
6 (b) (ii)	$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$ LHS with no numbers in front of formulae (1) RHS with no numbers in front of formulae (1)	allow correct multiples allow $Ca(HO)_2$ incorrect balancing of all correct formulae 1 mark max allow reactants on LHS and products on RHS in either order allow = for → reject incorrect use of cases and non-subscripts ignore state symbols	**(2)**

Question Number		Indicative Content	Mark
QWC	*6 (c)	A explanation to include some of the following points **IGNEOUS ROCKS** **basalt** • lava /magma /molten rock • forced up • cools quickly to form small crystals • solidifies • at the surface/extrusive **granite** • magma /molten rock • forced up • cools slowly to form large crystals • solidifies • under the ground/intrusive **SEDIMENTARY ROCKS** **limestone** • formed from layers of sediments and/or sea shells • sediments fall to bottom of sea • over long time period • compacted/squashed • by pressure • particles cemented together **METAMORPHIC ROCKS** **marble** • limestone {changed/metamorphosed} • by heat • (from) magma/molten rock • and pressure • (from) rocks above/buried deep underground	**(6)**

Level	0	No rewardable content
1	1 - 2	• A limited explanation of how at least one of the rocks was formed, e.g. molten rock cools quickly forming basalt • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	• A simple explanation of how at least three of the rocks were formed, e.g. molten rock cools quickly to form basalt and cools slowly to form granite. Marble was formed by heat and pressure. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	• A detailed explanation of how the four rocks were formed e.g. limestone was changed by heat and pressure to form marble. Granite was formed when molten rock cooled slowly to form large crystals, whereas basalt was formed when molten rock cooled quickly to form small crystals. Limestone was formed when layers of sediment build up on sea bed and are compacted over a long time to form rock. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

(Total for question 6 = 12 marks)

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Science

Unit C1: Chemistry in Our World

Higher Tier

Thursday 19 May 2016 – Morning
Time: 1 hour

Paper Reference
5CH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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Questions begin on next page.

Answer ALL questions

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Carbon dioxide

1 (a) The Earth's early atmosphere contained larger amounts of water vapour and carbon dioxide than it does today.

Explain how the amounts of water vapour and carbon dioxide in the Earth's atmosphere decreased.

(2)

(b) Describe how the presence of carbon dioxide in the atmosphere helps to keep the Earth warm.

(1)

(c) State a human activity, apart from burning fuels, that has increased the percentage of carbon dioxide in the atmosphere.

(1)

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(d) This table shows a set of data for the percentage of carbon dioxide in the atmosphere and the mean surface temperature of the Earth in the years 1960 and 2014.

year	percentage of carbon dioxide	mean surface temperature / °C
1960	0.0318	14.0
2014	0.0401	14.4

Suggest why this information does not prove that the increase in percentage of carbon dioxide alone has caused the increase in the mean surface temperature of the Earth.

(1)

.....

.....

(e) Hydrogen can be used as a fuel for cars.

(i) State one advantage and one disadvantage of using a car which uses hydrogen as the fuel rather than a car which uses petrol as the fuel.

(2)

.....

.....

.....

.....

(ii) Write the word equation for the reaction between hydrogen and oxygen.

(1)

.....

(Total for Question 1 = 8 marks)

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Rocks

2 (a) Granite is an igneous rock.

The size of crystals in granite vary.

Describe how a sample of granite which contains large crystals was formed.

(2)

(b) Limestone and marble are natural forms of calcium carbonate.

Limestone is a sedimentary rock.

Marble is a metamorphic rock, formed from limestone.

Describe how marble is formed from limestone.

(2)

(c) Calcium carbonate is used to treat waste gases in coal-fired power stations.

Explain why calcium carbonate can be used in this way.

(2)

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(d) (i) When calcium carbonate is heated, it breaks down to form calcium oxide and carbon dioxide.

What type of reaction is this?

Put a cross (☒) in the box next to your answer.

(1)

- ☐ **A** combustion
- ☐ **B** decomposition
- ☐ **C** oxidation
- ☐ **D** precipitation

(ii) Calcium oxide reacts with water to form calcium hydroxide, $Ca(OH)_2$.

Write the balanced equation for the reaction between calcium oxide and water.

(2)

.....

(Total for Question 2 = 9 marks)

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Acids and electrolysis

3 (a) Which of these substances is produced in the stomach to help digestion?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** calcium oxide

☒ **B** hydrochloric acid

☒ **C** magnesium oxide

☒ **D** sulfuric acid

(b) Nitric acid reacts with magnesium carbonate to form a salt, water and a gas.

(i) State the name of the salt formed in this reaction.

(1)

.....

(ii) Which of these is the gas produced in this reaction?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** carbon dioxide

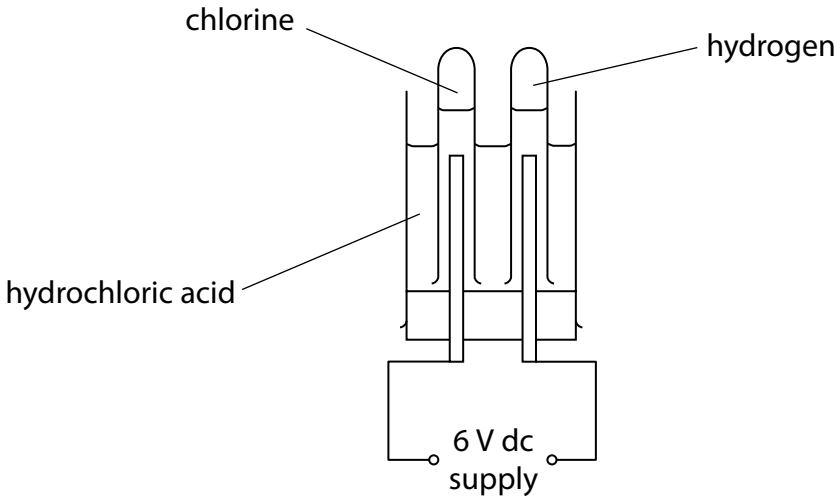
☒ **B** hydrogen

☒ **C** oxygen

☒ **D** nitrogen

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(c) Hydrochloric acid is electrolysed using this apparatus.
Hydrogen and chlorine are produced.



(i) Describe the test to show that a gas is chlorine.

(2)

(ii) Chlorine is a toxic gas.

State a safety precaution that should be taken when chlorine gas is formed in a reaction.

(1)

(iii) Write the balanced equation for the decomposition of hydrochloric acid to form hydrogen and chlorine.

(3)

(Total for Question 3 = 9 marks)

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Alkenes and polymers

4 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Alkenes are

☒ **A** saturated carbohydrates

☒ **B** saturated hydrocarbons

☒ **C** unsaturated carbohydrates

☒ **D** unsaturated hydrocarbons

(b) Propene is an alkene and has the molecular formula C_3H_6.

(i) Draw the structure of a propene molecule, showing all of the bonds.

(2)

(ii) Propane is an alkane.
Propane and propene are both gases.

Given a sample of each gas, describe a test, carried out on both gases, to show which gas is propane and which gas is propene.

(3)

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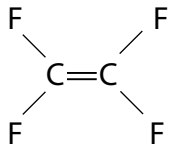
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(c) The diagram shows the structure of a tetrafluoroethene molecule.



Tetrafluoroethene can form the polymer PTFE.

(i) Draw a diagram to show part of a PTFE molecule formed from two tetrafluoroethene molecules.

(2)

(ii) PTFE does not allow other substances to stick to it.
State a use of PTFE related to this property.

(1)

.....

.....

(d) Many polymers cause problems because they persist for a long time when they are put in landfill sites.

State an alternative way of disposing of polymer waste.

(1)

.....

.....

(Total for Question 4 = 10 marks)

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Metals

5 (a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Aluminium is extracted from aluminium oxide by electrolysis.

The overall equation for this reaction is

$$2Al_2O_3 \rightarrow 4Al + 3O_2$$

In this reaction

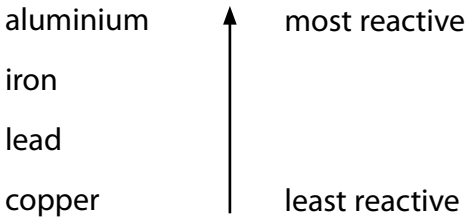
☒ **A** aluminium oxide is oxidised

☒ **B** aluminium oxide is reduced

☒ **C** aluminium metal is reduced

☒ **D** oxygen gas is oxidised

(ii) Part of the reactivity series is shown



Lead is extracted from its oxide by heating the oxide with carbon rather than by using electrolysis.

Explain why.

(2)

.....

.....

.....

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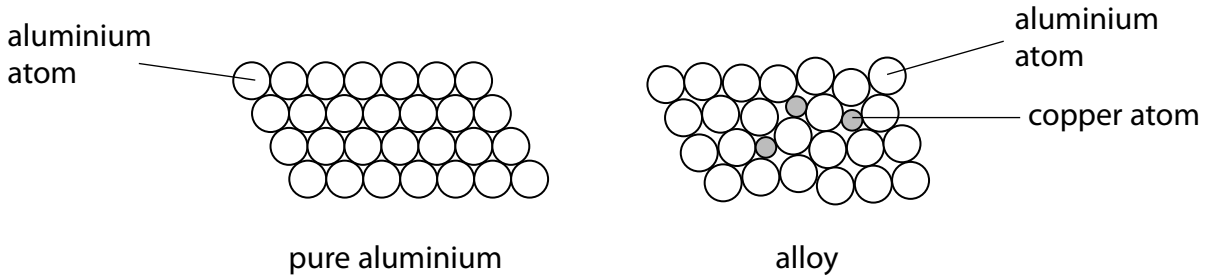
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(b) Pure aluminium is too weak for many uses.
Copper can be mixed with aluminium to produce an alloy.
The alloy is stronger than pure aluminium.

The diagrams show the structures of pure aluminium and the alloy.



pure aluminium alloy

Explain, in terms of these structures, how the presence of copper atoms in the alloy results in the alloy being stronger than pure aluminium.

(3)

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*(c) Iron in the form of steel, aluminium and copper are used to manufacture many useful articles.
These uses depend on their density, strength, electrical conductivity and resistance to corrosion.

Describe some uses of each of these metals in relation to their properties and the advantages of recycling these metals rather than extracting more of the metals from their ores.

(6)

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(Total for Question 5 = 12 marks)

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Products from crude oil

6 Crude oil is separated into different fractions by fractional distillation.

(a) Fraction X is obtained from near the top of the fractionating column.
Fraction Y is obtained from near the bottom of the fractionating column.

Which row of the table shows the boiling point, ease of ignition and viscosity of fraction X compared with fraction Y?

Put a cross (☒) in the box next to your answer.

(1)

	boiling point	ease of ignition	viscosity
☒ **A**	lower than Y	more difficult than Y	higher than Y
☒ **B**	lower than Y	easier than Y	lower than Y
☒ **C**	higher than Y	more difficult than Y	lower than Y
☒ **D**	higher than Y	easier than Y	higher than Y

(b) Pentane, C_5H_{12}, can be obtained from crude oil.
When pentane burns completely in air, it forms carbon dioxide and water.

Write the balanced equation for this reaction.

(3)

(c) Sulfur is present as an impurity in some fuels.

Explain how the product of combustion of this impurity in a fuel can damage the environment.

(2)

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*(d) The table below shows the percentages of three fractions obtained from crude oil and the percentages of these fractions required by customers.

fraction	number of carbon atoms in molecules	percentage obtained from crude oil	percentage required by customers
gases	1 to 4	2	5
petrol	5 to 10	10	26
kerosene	10 to 16	13	8

Oil companies use cracking to convert some of the molecules in the kerosene fraction into molecules with fewer carbon atoms.

Cracking can also be carried out on a small scale using liquid paraffin in a school laboratory.

Describe how cracking can be carried out in the laboratory experiment, explaining why it is necessary for oil companies to use cracking on some fractions obtained from crude oil.

You may wish to use diagrams to help parts of your answer.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCSE in Chemistry (5CH1H) Paper 01
Unit C1: Chemistry in Our

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(a)	An explanation linking water vapour: condensed/turned to liquid/turned to water/ cooled AND formed oceans/ formed rain **(1)** carbon dioxide: dissolved/absorbed in the {water/ oceans/rivers/lakes} (**1**)	 **Ignore** 'turned to/ formed oceans/seas' etc if not explained **how** this happened photosynthesis / incorporated into rocks/ shells **Ignore** descriptions of photosynthesis –term is required	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)	Heat is: trapped / absorbed / stopped from escaping / reflected back / radiated back IR radiation is absorbed etc.	**Ignore** radiation/ UV/ rays/ warmth/ light/ Sun's rays / energy/ it's an insulator/ insulates Earth/ keeps Earth warm/ greenhouse gas **Reject** references to ozone layer	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)	deforestation / respiration	**Ignore** farming/ increased population/ breathing/ use of cars/ industry **Reject** photosynthesis/ volcanic activity	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)	other factors could be causing the temperature to rise / correlation is not cause / not enough data to establish trend / no data between the two stated years	insufficient evidence /could be due to methane or other (greenhouse) gases **Ignore** only small temp. rise / could be anomalous etc / different percentage changes in conc. and temp.	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(e)(i)	Advantage Any one from: • only water is produced / no CO_2 or CO or SO_2 / no pollutants / no waste products / no toxic gases/ no harmful gases/ no hazardous gases • sustainable / preserves crude oil or fossil fuels / renewable • more energy **per gram** / per unit mass • can be produced in unlimited amounts (from water) **(1)** Disadvantage Any one from: • expensive to produce • difficult to store/ transport • limited outlets/ low availability of filling stations • has to be stored in strong tanks / at high pressure **(1)**	**Ignore** better for environment / less pollution / cleaner fuel / refs to unspecified greenhouse gases / just releases more energy **Ignore** cost arguments other than production **Ignore** may need fossil fuel to produce hydrogen **Ignore** 'dangerous'/ **explosive** etc.	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(e)(ii)	hydrogen + oxygen → water	$2H_2 + O_2 \rightarrow 2H_2O$ **Reject** any other symbol equation (incorrectly balanced) or mixed words and symbols / hydrogen oxide – only water allowed / energy as a product **Allow** = for →	**(1)**

Total for Question 1 = 8 marks

Question Number	Answer	Acceptable answers	Mark
2(a)	A description including magma/lava/molten/liquid rock **(1)** cools/forms/solidifies: slowly / over a long time / intrusively/ below Earth's surface **(1)**	**Reject** answers explaining metamorphic or sedimentary processes for both marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	A description including heat / high temp. **(1)** pressure **/** compressed / compacted **(1)**		**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	An explanation linking **two** of the following points waste gas is sulfur dioxide / is acidic **(1)** calcium carbonate is a base **(1)** neutralisation/ neutralise **(1)**	two marks can be scored with suitable balanced equation **Ignore** calcium carbonate is an alkali	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(d)(i)	B decomposition		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(d)(ii)	$CaO + H_2O \rightarrow Ca(OH)_2$ correct balanced equation **(2)** any two correct formulae on the correct side of the equation **(1)**	**Allow** correct multiples **Ignore** state symbols **Ignore** word equations **Reject** incorrect subscripts e.g. H^2O, H2O	**(2)**

Total for Question 2 = 9 marks

Question Number	Answer	Acceptable answers	Mark
3(a)	B hydrochloric acid		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	magnesium nitrate	**Ignore** any symbols or formulae	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	A carbon dioxide		**(1)**

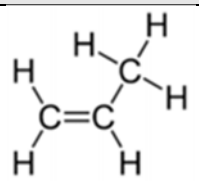
Question Number	Answer	Acceptable answers	Mark
3(c)(i)	A description including the following litmus **(1)** turns white /bleaches (**1**) second mark is dependent on the first	**Allow** UI paper **Ignore** any colour (changes) before bleaching; but **reject** further colour changes after bleaching	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	use fume cupboard / well ventilated room	**Allow** open windows **Ignore** gas mask / breathing apparatus etc / any other general safety precautions	**(1)**

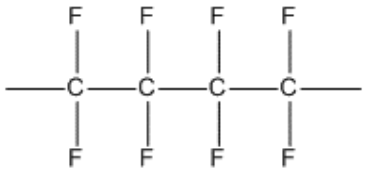
Question Number	Answer	Acceptable answers	Mark
3(c)(iii)	$2HCl \rightarrow H_2 + Cl_2$ LHS formula **(1)** RHS formulae **(1)** balancing correct formulae **(1)**	**Allow** correct multiples **Ignore** state symbols/ word equations **Reject** lower case h or c or upper case L/ incorrect subscripts e.g. H^2, H2 **Allow =** for →	**(3)**

Total for Question 3 = 9 marks

Question Number	Answer	Acceptable answers	Mark
4(a)	D unsaturated hydrocarbons		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	 **one** C=C in a **three** consecutive carbon atom molecule **(1)** rest of the structure correct **(1)** **conditional** on first mark correct	**Allow** methyl group written as CH_3 **Ignore** bond angles **Penalise** h/c instead of H/C for M2	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	A description including add bromine (water/solution) **(1)** In propene/alkene: turns colourless/decolourises **(1)** In propane/alkane: orange/yellow/brown / no change/does not go colourless **(1)** For incorrect reagent, score 0 (except bromide where M2 and M3 possible)	 **Ignore** bromide for M1 but mark on assuming they meant bromine for M2, M3 **Ignore** clear/ transparent/ discolours **Reject** incorrect bromine colour for M3 only **Ignore** red **Ignore** no reaction **Allow** 'turns orange' **Ignore** attempted descriptions (e.g. linking to saturated/ unsaturated) even if wrong	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	 correct repeating unit (any multiple of 2; with or without brackets, continuation bonds or n) **(1)** **two** correct units shown with continuation bonds and no "n" **(1)**	Any answer with one or more double bonds scores **(0)** **Ignore** any outside brackets	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	(Making) any <u>named object</u> from: pans/kitchen utensils /skis/ bearings /burette taps/ carpets/clothing or as a lubricant	**Allow** sensible alternatives	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(d)	Any one from recycle/incinerate/burn/combust	reuse the items made from polymers **Allow** descriptions e.g. melt AND remould	**(1)**

Total for Question 4 = 10 marks

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	**B** aluminium oxide is reduced		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	An explanation linking lead is {lower in reactivity series/ less reactive} than iron or aluminium or carbon **(1)** **AND one from** lead (oxide) can be reduced by carbon/ carbon can displace lead from its oxide lead oxide is less stable / more easily reduced than iron oxide or aluminium oxide electrolysis is expensive/ reduction with carbon is cheap(er) **(1)**	M1 requires comparison carbon is oxidised / oxygen is displaced **Allow** descriptions e.g oxygen is removed from lead oxide by carbon	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)	An explanation linking any three of ALUMINIUM/ PURE METAL • atoms/ions/ particles all the same size **(1)** • {atoms/ions/layers/sheets/rows} {slide/slip/move} over each other easily **(1)** ALLOY • added atoms are different size/ {atoms/ions} in an alloy have different sizes **(1)** • {atoms/layers/sheets/rows/ structure/lattice} disrupted / {cannot/harder to} move **(1)**	marks can be obtained from **labels** on diagrams that equate to the marking points **Ignore** different shape **Reject** molecules once then mark on	**(3)**

<table>
<tr><th colspan="2">Question Number</th><th>Indicative Content</th><th>Mark</th></tr>
<tr><td>QWC</td><td>*5(c)</td><td>
A description / explanation including some of the following points
Uses and properties
<table>
<tr><th>Examples of use</th><th>Examples of properties</th></tr>
<tr><td>aluminium</td><td></td></tr>
<tr><td>aeroplanes, cars, bicycles, trains, trucks, ladders, window frames, door frames, greenhouses, pylons, yacht masts, walking poles</td><td>low density/lightweight, strong, resistant to corrosion, malleable</td></tr>
<tr><td>(overhead) power/electricity cables</td><td>low density/lightweight, good conductor of electricity, resistant to corrosion</td></tr>
<tr><td>foil, food packaging, cans, sweet wrappers, saucepans, blister packs for pills</td><td>low density/lightweight [Ignore light] resistant to corrosion, malleable, non-toxic</td></tr>
<tr><td>copper</td><td></td></tr>
<tr><td>electrical wires/cables, lightning conductors</td><td>good conductor of electricity, malleable, ductile</td></tr>
<tr><td>water pipes, roofing, coins, jewellery, statues</td><td>resistant to corrosion, malleable</td></tr>
<tr><td>steel</td><td></td></tr>
<tr><td>bridges, cars, hulls of (large) ships, construction</td><td>strong</td></tr>
<tr><td>(stainless) steel</td><td></td></tr>
<tr><td>cutlery, saucepans, kitchen utensils, kitchen sinks, washing machine drums, exhaust systems</td><td>resistant to corrosion, strong</td></tr>
</table>
Advantages of recycling

saves (finite) natural reserves of metal ores / stops the metal (ore) running out
less damage to the landscape/environment since reduces the need for mining or quarrying ores
less waste metals (in landfill sites)
landfill sites will not fill up as quickly
waste (from copper mining) can be toxic/less toxic gases, such as sulfur dioxide
less energy needed to recycle than to extract (for most metals) / less carbon dioxide emissions
less expensive than using electrolysis

Ignore cost
</td><td>(6)</td></tr>
</table>

Level	0	No rewardable content
1	1 - 2	• a limited description e.g. gives one use related to a property or explain one advantage of recycling • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	• a simple description e.g. answer refers to at least two uses of metals giving the use related to their properties OR gives a use of a metal related to its property and a simple explanation of an advantage of recycling • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	• a detailed description e.g. answer refers to at least two metals giving three uses related to their properties OR gives uses related to properties of metals and discusses recycling • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for Question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
6(a)	B boiling point lower than Y, ease of ignition easier than Y, viscosity lower than Y.		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	$C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$ LHS formulae **(1)** RHS formulae **(1)** balancing correct formulae **(1)**	ignore state symbols **Reject** incorrect subscripts and cases e.g. CO^2, CO2, Co_2 **Allow** multiples, =	**(3)**

Question Number	Answer	Acceptable answers	Mark
6(c)	An explanation linking any **two** of the following <u>sulfur **di**oxide/SO_2</u> **(1)** (gas) {dissolves in/ reacts with} rain /forms {acid rain/an acid/sulfuric acid} **(1)** an effect of acid rain eg: harms/kills {fish/plants}/ damages/corrodes metals/ damages/erodes/weathering {statues/ buildings}/ causes {lung damage/ breathing problems} **(1)**	**Ignore** sulfur/ sulfur oxide for M1 but mark on **Ignore** 'pollutes water'/ 'acidifies water/lakes' / damages habitats etc	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	A description/explanation including some of the following points **Description of experiment** • heat liquid paraffin/ alkane • (pass paraffin vapour) over hot porcelain/porous pot/catalyst • collect gas over water Some of these points could be made on a labelled diagram **Need for cracking: supply and demand** • too little gases / petrol fraction • high demand for petrol • there is more of the kerosene fraction than is needed from crude oil to match demand / ORA • stops over-production / makes better use of kerosene • produces smaller/ more in demand alkanes / more useful alkanes **Need for cracking: properties** • shorter molecule easier to ignite etc • produces alkenes (to make plastics)/ polymers Credit correct diagrams or equations **Ignore** fractional distillation	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of the need for cracking or cracking in the laboratory e.g. heat liquid paraffin and pass over catalyst • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description of the need for cracking or cracking in the laboratory e.g explains two advantages/reasons for undertaking cracking • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed account to include advantages/reasons for cracking **and** details of the cracking process in the laboratory. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	
			Total for Question 6 = 12 marks

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Science

Unit C1: Chemistry in Our World

Higher Tier

Thursday 14 May 2015 – Morning
Time: 1 hour

Paper Reference
5CH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 4 6 8 2 A 0 2 2 4

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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Questions begin on next page.

Answer ALL questions

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Limestone

1 Limestone is a sedimentary rock.

(a) Describe how sedimentary rocks, such as limestone, are formed.

(3)

.....

.....

.....

.....

.....

.....

(b) Limestone in the Earth's crust is converted into marble by the action of heat and pressure.

State the type of rock formed.

(1)

.....

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(c) Limestone is a natural form of calcium carbonate.

A piece of calcium carbonate is heated strongly.
It forms solid calcium oxide and a gas.
The masses of the solids before and after heating were found.

mass of calcium carbonate before heating = 3.75 g
mass of calcium oxide remaining after heating = 2.10 g

(i) Calculate the mass of gas that was given off.

(1)

.....

mass of gas given off = ... g

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The gas given off when calcium carbonate is heated is

(1)

☒ **A** carbon

☒ **B** oxygen

☒ **C** carbon monoxide

☒ **D** carbon dioxide

(d) Calcium carbonate and calcium hydroxide are both used by farmers to treat some soils.

Explain why calcium carbonate and calcium hydroxide are used in this way.

(2)

.....

.....

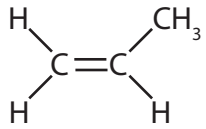
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(Total for Question 1 = 8 marks)

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Propene

2 The structure of a molecule of propene is



(a) Propene is an unsaturated hydrocarbon.

(i) Explain what is meant by **unsaturated hydrocarbon**.

(3)

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

Propene can be made by using heat to decompose large alkane molecules into smaller, more useful molecules.

This process is known as

(1)

☒ **A** combustion

☒ **B** cracking

☒ **C** fractional distillation

☒ **D** polymerisation

(iii) Describe what is seen when a sample of propene is shaken with bromine water.

(2)

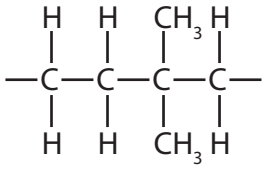
(b) Molecules of propene can be combined to form a molecule of poly(propene).

(i) Which of these shows part of the structure of a molecule of poly(propene)?

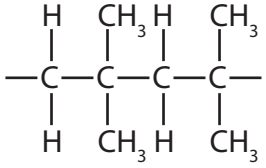
Put a cross (☒) in the box next to your answer.

(1)

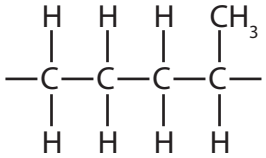
☒ **A**



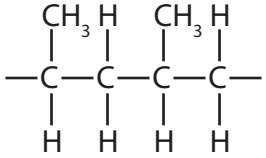
☒ **B**



☒ **C**



☒ **D**



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(ii) Ropes used on boats are often made from poly(propene).



State a property of poly(propene) that makes it suitable for use as ropes on boats.

(1)

.....

(iii) State a problem caused by the disposal of poly(propene) ropes in landfill sites.

(1)

.....

.....

.....

(Total for Question 2 = 9 marks)

The atmosphere

3 The Earth's atmosphere today has changed, when compared with the Earth's earliest atmosphere.

(a) Two processes that caused changes were the cooling of the atmosphere and photosynthesis.

(i) State how cooling changed the composition of the Earth's atmosphere.

(1)

.....

.....

(ii) Explain how photosynthesis changed the composition of the Earth's atmosphere.

(2)

.....

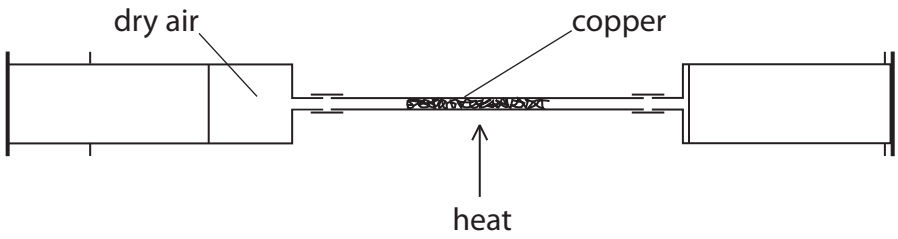
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(b) In an experiment, dry air is passed backwards and forwards over hot, excess copper in the apparatus shown.

The oxygen in the air reacts with the hot copper to form copper oxide, CuO.



(i) Write the balanced equation for the reaction of copper with oxygen.

(3)

.....

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(ii) When the copper has reacted with all the oxygen, the apparatus is allowed to cool.

The initial volume of dry air in the apparatus was 50 cm^3, measured at room temperature and pressure.
During the experiment the volume of gas in the apparatus decreased.

Calculate the final volume of gas remaining in the apparatus after allowing it to cool to room temperature.
(percentage of oxygen in dry air is 21%)

(2)

.....

.....

.....

.....

final volume of gas remaining in apparatus = ... cm^3

(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

After the reaction between dry air and copper is complete, most of the gas remaining in the apparatus is

(1)

☒ **A** argon

☒ **B** carbon dioxide

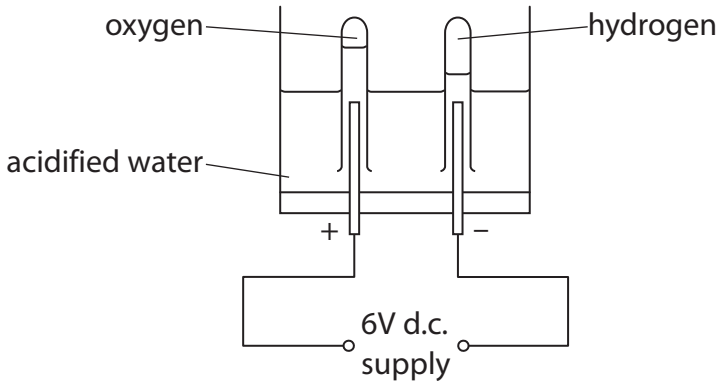
☒ **C** nitrogen

☒ **D** oxygen

(Total for Question 3 = 9 marks)

Electrolysis and acids

4 (a) Water, acidified with a small amount of dilute sulfuric acid, can be decomposed by electrolysis using the apparatus shown.



(i) State the form of energy used to carry out the electrolysis.

(1)

.....

(ii) During the electrolysis, hydrogen is formed at one of the electrodes.

Describe a test to show that this gas is hydrogen.

(2)

.....

.....

.....

.....

(b) Electrolysis is also used to produce chlorine on a large scale.

Name a raw material that can be electrolysed to produce chlorine.

(1)

.....

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(c) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

Acids are neutralised by metal hydroxides to form

(1)

☒ **A** salt only

☒ **B** salt and hydrogen only

☒ **C** salt and oxygen only

☒ **D** salt and water only

(ii) Acids can also be neutralised by metal carbonates.

Dilute sulfuric acid is neutralised by copper carbonate as shown in the word equation.

copper carbonate + sulfuric acid → copper sulfate + carbon dioxide + water

Copper carbonate is a green powder.

Describe what you would **see** when copper carbonate powder is added to dilute sulfuric acid.

(2)

.....

.....

.....

.....

(d) Two experiments were carried out to test the effectiveness of tablets of three different indigestion remedies, A, B and C.

For each remedy, the experiments were carried out on both a whole and a crushed tablet.

In experiment 1, each tablet was added to excess hydrochloric acid and the time taken for the tablet to react completely was recorded.

In experiment 2, the volume of acid neutralised by each tablet was determined.

The table shows the results obtained for the investigation.

tablet of	state of tablet	experiment 1 : time taken for the tablet to react completely / s	experiment 2 : volume of acid neutralised / cm^3
A	whole	75	25.0
	crushed	30	25.0
B	whole	59	25.0
	crushed	19	25.0
C	whole	120	50.0
	crushed	44	50.0

(i) Explain, using information from the table, which of the tablets contains the most of the active ingredient to overcome indigestion.

(2)

.....

.....

.....

.....

(ii) Explain, using information from the table, whether faster relief of indigestion is achieved by using a given tablet whole or crushed.

(1)

.....

.....

.....

(Total for Question 4 = 10 marks)

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Fuels and crude oil

5 (a) Some fuels are better fuels than others.

State one factor that makes a good fuel.

(1)

.....

.....

(b) Bioethanol is a fuel that can be obtained from the plant, sugar beet.

(i) Bioethanol and petrol can both be used as fuels.

Explain one advantage of using bioethanol produced from sugar beet, rather than petrol produced from crude oil.

(2)

.....

.....

.....

.....

(ii) The main component of bioethanol is ethanol.

When burnt completely, ethanol, C_2H_5OH, reacts with oxygen to produce carbon dioxide and water.

Write the balanced equation for this reaction.

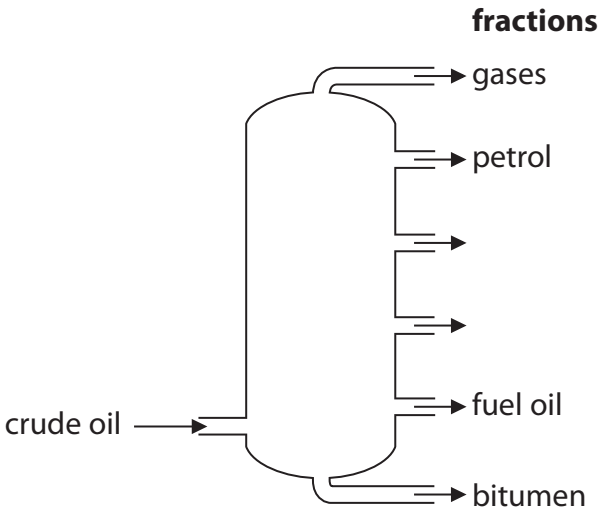
(3)

.....

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*(c) Useful products can be obtained by the fractional distillation of crude oil.

The diagram shows a fractional distillation column and the fractions obtained.



The petrol fraction is obtained from near the top of the column.
The bitumen fraction is obtained from the bottom of the column.

Explain how the petrol and bitumen fractions differ in their properties and uses.

(6)

(Total for Question 5 = 12 marks)

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Metals

6 The list shows some metals in order of reactivity.

most reactive	sodium
	aluminium
	zinc
	iron
	copper
least reactive	gold

(a) Aluminium and iron are extracted by reduction of their oxides.

State what is meant by reduction.

(1)

.....

.....

(b) Electrolysis and heating with carbon are two methods of reduction.

Explain why aluminium needs to be extracted from its ore by electrolysis, rather than by heating with carbon.

(2)

.....

.....

.....

.....

.....

(c) Iron is extracted from iron oxide, Fe_2O_3.

In the extraction process the iron oxide is heated with carbon to form iron and carbon dioxide.

Write the balanced equation for this reaction.

(3)

.....

*(d) Pure metal can be converted into alloys.

In many cases alloys are more useful than pure metals, for example they are stronger. Gold alloys, stainless steel and nitinol are examples of useful alloys.

Describe how alloying improves the usefulness of metals and how strength is increased in terms of structure.

You may use diagrams to help your answer.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCSE in Chemistry (5CH1H) Paper 01
Unit C1: Chemistry in Our World

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(a)	A description including three from • sediments (form) /{small rocks / pebbles / stones / shells / animals} {are deposited (on the sea bed) / fall to the bottom (of the sea bed)} (1) • layering / layers (1) • compaction / (sediments / layers) {compacted / compressed / under pressure} / sediments stuck together / particles 'cemented' together (1) • over millions of years / long time (1)	allow sediments transported as alternative to sediments form accept any reference to layering ignore hundreds / thousands descriptions of igneous or metamorphic rock formation scores 0	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(b)	metamorphic		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	3.75 – 2.10 (1) (= 1.65 (g))	1.65 (g)	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	**D** carbon dioxide		**(1)**

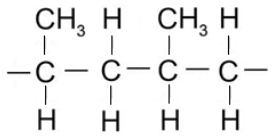
Question Number	Answer	Acceptable answers	Mark
1(d)	An explanation linking • (they) neutralise / react with (acid soils) (1) • acid (substances in soils) / acidity (1)	 allow increase pH (calcium carbonate and calcium hydroxide) are basic /alkaline reduce acidity (1)	**(2)**

Total for Question 1 = 8 marks

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	An explanation linking (a compound containing) • hydrogen and carbon (1) • (hydrogen and carbon) only (1) • contains double / multiple bond (between carbon atoms) (1)	 ignore H and C reject {ions/molecule} of carbon and hydrogen reject mixture reject oxygen ignore 'spare bonds' allow carbon atoms not joined to the maximum number of other atoms	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	**B** cracking		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	A description to include • (bromine water is) orange (1) • decolourises / turns colourless (1)	 allow brown / yellow or combinations eg orange-yellow ignore red (alone) ignore clear / changes colour / discolour	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	**D** 		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	waterproof / rot-proof / strong / flexible / does not react with oxygen / water resistant / weather proof	allow durable / tough ignore ductile / stretchy	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iii)	not biodegradable / persist in landfill sites / does not decompose	ignore answers in terms of burning / allow takes a long time to rot / decompose / takes up space in landfill	**(1)**

Total for Question 2 = 9 marks

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	answer must refer to water vapour water vapour condensed / rain falls / water vapour removed / (water vapour) turns to water		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	An explanation linking • carbon dioxide (level) reduced (1) • so oxygen (level) increased (1)	carbon dioxide turned into oxygen (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	$2Cu + O_2 \rightarrow 2CuO$ (3) lhs (1) rhs (1) balancing of correct formulae (1)	accept multiples ignore state symbols even if incorrect	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	$\frac{21}{100}$ x 50 (1) (= 10.5 cm^3) 50 minus answer to previous step (1) or 100 – 21 (1) (= 79 cm^3) $\frac{79}{100}$ x 50 (1) (= 39.5 cm^3)	correct answer with no working / 39.5 (cm^3) (2) allow TE allow TE	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(iii)	**C** nitrogen		**(1)**

Total for Question 3 = 9 marks

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	electrical (energy) / electricity / direct (electric) current		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	A description including • {light / ignite} gas / lighted splint (1) • gas burns / (squeaky) pop (if air is present) (1)	 reject glowing splint second mark conditional on first	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)	sea water / salt / brine / sodium chloride (solution)		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	**D** salt and water only		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	A description to include two from • (green) solid {disappears / dissolves} (1) • effervesces / bubbles (of colourless gas) given off (1) • blue (solution) forms (1)	 ignore references to names of products fizz goes blue ignore incorrect colours of solution ignore temperature rise	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)(i)	An explanation linking • tablet C (1) • because it neutralises greatest volume of acid (1)	ignore references to rate	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)(ii)	• {crushed tablets / chewed tablets} have a shorter reaction time (than whole tablets) (1)	ignore crushed because times are quicker / larger surface area / do not need to break down	**(1)**

Total for Question 4 = 10 marks

Question Number	Answer	Acceptable answers	Mark
5(a)	<u>burns</u> easily / <u>produces</u> little ash / <u>produces</u> little smoke / <u>produces</u> high heat energy (per unit mass) / <u>easy</u> to {store / transport}	'renewable' / few pollutants / few emissions / easy to ignite / burns cleanly Ignore references to cost	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	An explanation linking • an advantage • with a linked reason examples include • bioethanol is always available / crude oil is finite (1) • because more sugar beet can be grown / crude oil takes a long time to form / bioethanol conserves crude oil (1) OR • bioethanol produces less carbon dioxide (1) • because bioethanol is 'carbon neutral' / ora (1) OR • bioethanol uses less energy in production (1) • because fermentation does not require energy / crude oil must be heated to obtain petrol (1)	 allow crops (= sugar beet) allow renewable bioethanol is less polluting	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ (3) lhs (1) rhs (1) balancing correct formulae (1)	allow multiples ignore state symbols even if incorrect.	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	An explanation linking some of the following points properties • petrol has shorter (carbon) chains /ORA • petrol has lower {melting point / boiling point} / ORA • petrol has lower viscosity / ORA • petrol {ignites / burns} more easily / ORA • bitumen does not combust completely (due to high number of carbon atoms per molecule) • burning bitumen produces lots of carbon monoxide/soot uses of petrol fraction • fuels in cars / in motorbikes / transportation uses of bitumen fraction • used for road (surfacing) • used for roofing / flooring	**(6)**
Level	**0**	No rewardable content	
1	**1 – 2**	• a limited explanation of petrol or bitumen eg petrol easily ignites • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 – 4**	• a simple explanation of at least two properties or uses of petrol or bitumen or a combination of uses and properties eg petrol from the top ignites easily, has a low boiling point and is used as a fuel. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 – 6**	• a detailed explanation of at least two different properties of petrol or bitumen **and** at least one use of petrol and at least one use of bitumen eg petrol has a lower boiling point and is used as a fuel in cars, bitumen is more viscous and is used to surface roads. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
6(a)	loss of oxygen	gain of electrons	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	An explanation to include • aluminium high in reactivity series / aluminium more reactive than {carbon / iron} (1) • (aluminium reduction) needs more energy / electrolysis is {more / very} powerful (means of reduction) / carbon cannot displace aluminium (from aluminium oxide) (1)	 aluminium compounds are stable aluminium is more reactive ignore just 'very reactive'/highly reactive allow stronger (method of reduction)	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(c)	$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$ (3) lhs (1) rhs (1) balancing correct formulae (1)		**(3)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	A description including some of the following points **Property change (other than increased strength) or use of alloy** • increased hardness • decreased malleability • increased corrosion resistance • shape-memory • gold alloy for jewellery • stainless steel used for cutlery • steel used for construction • nitinol (shape-memory alloy) used for spectacle frames / stents • idea of any use of metal after alloying **Structural change** • pure metal – atoms are all the same size / suitable diagram of pure metal structure • atoms arranged in a regular way / lattice • alloy – atoms are of different sizes / suitable diagram of alloy structure • disrupts arrangement of atoms • atoms in pure metal structure can slide over each (when bent) • alloy – sliding prevented by different sized atoms	**(6)**

Level	0	No rewardable content
1	**1 – 2**	• a limited description of how one property changes, one use or one statement related to structure eg iron rusts, stainless steel does not; atoms in a pure metal all the same size • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 – 4**	• a simple description of how two properties change or two uses **or** a simple description of why alloys become stronger or a property/use and a statement about structure eg the atoms in a pure metal have a regular arrangement but in alloys there are different sized atoms • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 – 6**	• a detailed description of why alloys become stronger including at least one change in property of an alloy or use eg the atoms in a pure metal have a regular arrangement but in alloys the different sized atoms stops the atoms sliding over each other and how alloys are more useful such as gold alloys used in jewellery • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for Question 6 = 12 marks

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Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Science

Unit C1: Chemistry in Our World

Higher Tier

Thursday 15 May 2014 – Morning
Time: 1 hour

Paper Reference
5CH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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Questions begin on next page.

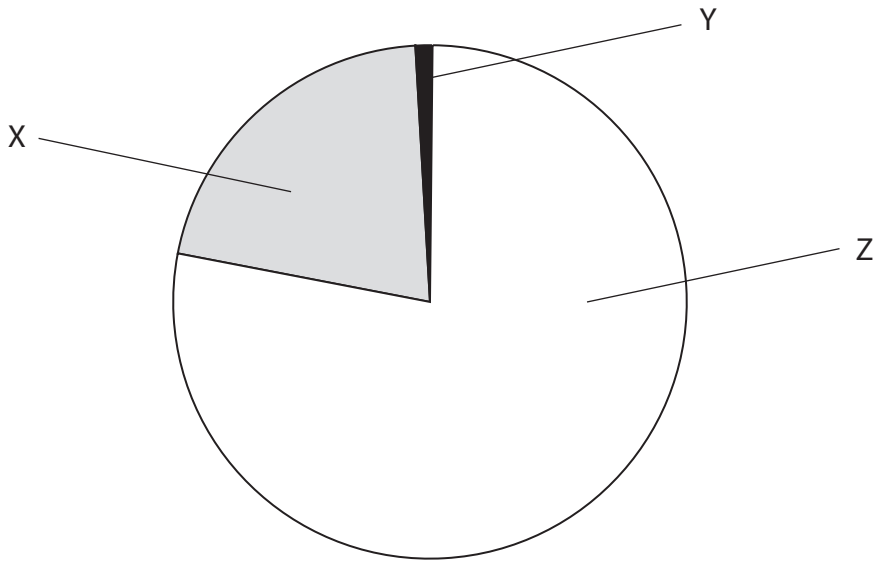
Answer ALL questions

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The Earth's atmosphere

1 The Earth's atmosphere today contains a mixture of different gases.

(a) The pie chart shows the percentages of nitrogen, oxygen and other gases in the atmosphere.



Which row of the table identifies X, Y and Z correctly?

Put a cross (☒) in the box next to your answer.

(1)

	X	Y	Z
☒ **A**	oxygen	nitrogen	other gases
☒ **B**	other gases	oxygen	nitrogen
☒ **C**	oxygen	other gases	nitrogen
☒ **D**	nitrogen	other gases	oxygen

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(b) (i) The percentage of oxygen in the atmosphere has increased since the Earth's earliest atmosphere.

Describe the process that has caused this change.

(2)

.....

.....

.....

(ii) Describe a test to show a gas is oxygen.

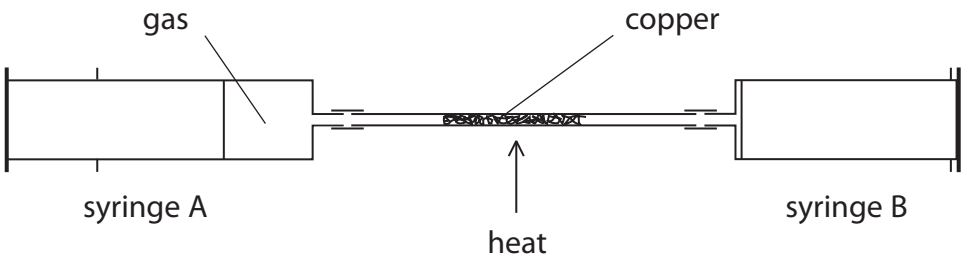
(2)

.....

.....

.....

(c) This apparatus is used to find the volume of oxygen in 100 cm^3 of air.



When heated, copper reacts with oxygen in the air to form copper oxide.

Syringe A contains 100 cm^3 of air, syringe B contains no air.
The hard glass tube contains excess copper.
The copper is heated strongly and the air is passed backwards and forwards over the copper until no more copper reacts.
The apparatus is then left to cool.

(i) State why an excess of copper must be used.

(1)

.....

.....

.....

(ii) Explain how this experiment can be used to find the volume of oxygen in 100 cm^3 of air.

(2)

.....

.....

.....

.....

(Total for Question 1 = 8 marks)

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Materials from the Earth

2 (a) Limestone and marble are naturally occurring forms of calcium carbonate.

(i) Which of the following is the formula of calcium carbonate?

Put a cross (☒) in the box to show your answer.

(1)

☐ **A** CaCO

☐ **B** $CaCO_2$

☐ **C** $CaCO_3$

☐ **D** $CaCO_4$

(ii) Give a large scale use of limestone.

(1)

.....

.....

(iii) Marble is an example of a metamorphic rock.

Explain how marble is formed from limestone.

(2)

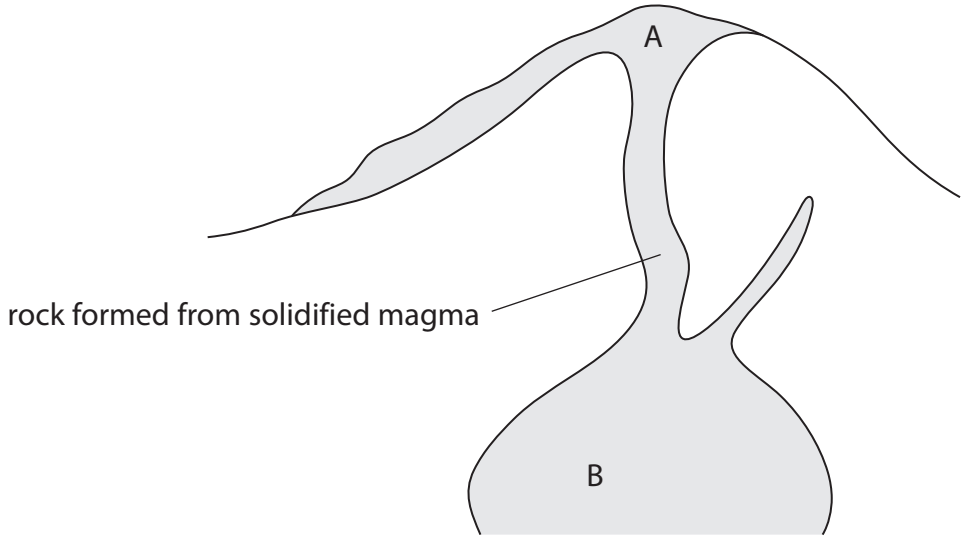
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(b) The diagram shows a cross-section through an extinct volcano.



Millions of years ago, molten magma pushed up to the Earth's surface.

The magma cooled and solidified to form rock.

The rock at A and the rock at B differ in appearance.

(i) Describe the appearance of the rock at A and the rock at B.

(1)

.....

.....

.....

(ii) Describe how the magma cooled in different ways to form the rock at A and the rock at B.

(1)

.....

.....

.....

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(c) When calcium carbonate is heated calcium oxide is formed.

Calcium oxide reacts with water to form calcium hydroxide.

Write the balanced equation for the reaction of calcium oxide with water to form calcium hydroxide.

(2)

.....

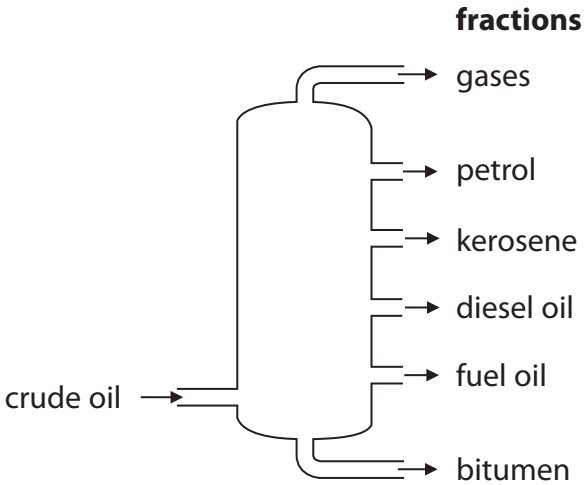
(Total for Question 2 = 8 marks)

Fuels

3 Crude oil is a mixture of hydrocarbons.

(a) Crude oil is separated into fractions by fractional distillation.

The diagram shows a fractional distillation column and the fractions.



There are trends in the properties of the fractions from the top of the column to the bottom of the column.

Which of the following describes a correct trend from top of the column to the bottom?

Put a cross (☒) in the box to show your answer.

(1)

- ☒ **A** the boiling points decrease
- ☒ **B** the ease of ignition decreases
- ☒ **C** the viscosity decreases
- ☒ **D** the number of carbon atoms in a molecule decreases

(b) Describe problems caused by one product of the incomplete combustion of a hydrocarbon fuel.

(2)

.....

.....

.....

.....

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(c) (i) When fuel oil is burnt, carbon dioxide is produced and released into the atmosphere.

Explain why some people are concerned about the release of large quantities of carbon dioxide into the atmosphere.

(2)

(ii) Fuel oil can contain sulfur as an impurity.

Explain how burning this impurity can cause problems in the environment.

(3)

(d) Crude oil is a source of many fuels.

These fuels are known as fossil fuels.

Describe advantages of replacing fossil fuels with biofuels.

(2)

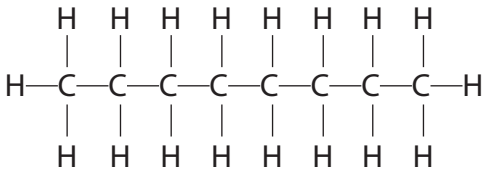
(Total for Question 3 = 10 marks)

Fuels

4 (a) Petrol is obtained by the fractional distillation of crude oil.

One substance present in petrol is octane, C_8H_{18}.

The structure of a molecule of octane is shown.



(i) Octane is a saturated hydrocarbon.

Explain what is meant by **saturated hydrocarbon**.

(3)

(ii) Octane is mixed with bromine water and shaken.

Complete the sentence by putting a cross (☒) in the box next to your answer.

On shaking, the colour of the mixture

(1)

☒ **A** remains orange

☒ **B** remains colourless

☒ **C** changes from clear to orange

☒ **D** changes from orange to colourless

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(b) In the oil industry some fuel oil fraction is converted into petrol.

This is done by heating the fuel oil fraction to thermally decompose it and produce smaller molecules.

(i) State the name given to this process.

(1)

.....

(ii) Give **two** reasons why it is necessary to carry out this process to make more petrol.

(2)

reason 1 .....

.....

reason 2 .....

.....

(c) Methane can be burned in excess oxygen to form carbon dioxide and water.

Write the balanced equation for this reaction.

(3)

.....

(Total for Question 4 = 10 marks)

Acids

5 (a) Magnesium carbonate reacts with dilute nitric acid.

Give the names of the products formed in this reaction.

(2)

.....

(b) Zinc oxide, ZnO, reacts with dilute hydrochloric acid to form zinc chloride, $ZnCl_2$, and water.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

This reaction is an example of

(1)

☒ **A** combustion

☒ **B** thermal decomposition

☒ **C** neutralisation

☒ **D** oxidation

(ii) Write the balanced equation for the reaction between zinc oxide and dilute hydrochloric acid.

(3)

.....

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*(c) Electrolysis of hydrochloric acid can produce hydrogen and chlorine.

The apparatus for the electrolysis is

hydrochloric acid

two carbon rods

a suitable container for the electrolysis reaction

a suitable source of electricity

test tubes

Describe how the apparatus can be used to electrolyse hydrochloric acid and how the gases produced can be tested to show that they are hydrogen and chlorine.

You may use a diagram to help your answer.

(6)

(Total for Question 5 = 12 marks)

Metals

6 (a) In the extraction of tin from tin oxide, tin oxide is heated with carbon.

$$SnO_2 + C \rightarrow Sn + CO_2$$

Complete the sentence by putting a cross (☒) in the box next to your answer.

When the tin oxide reacts with carbon to form the products

(1)

- ☒ **A** tin is oxidised
- ☒ **B** tin oxide is reduced
- ☒ **C** carbon is reduced
- ☒ **D** carbon dioxide is oxidised

(b) Pure gold is too soft to be used for some jewellery.

(i) Gold alloys contain other metals such as copper and silver.

In terms of the arrangement of metal atoms, explain why gold alloys are stronger than pure gold.

(2)

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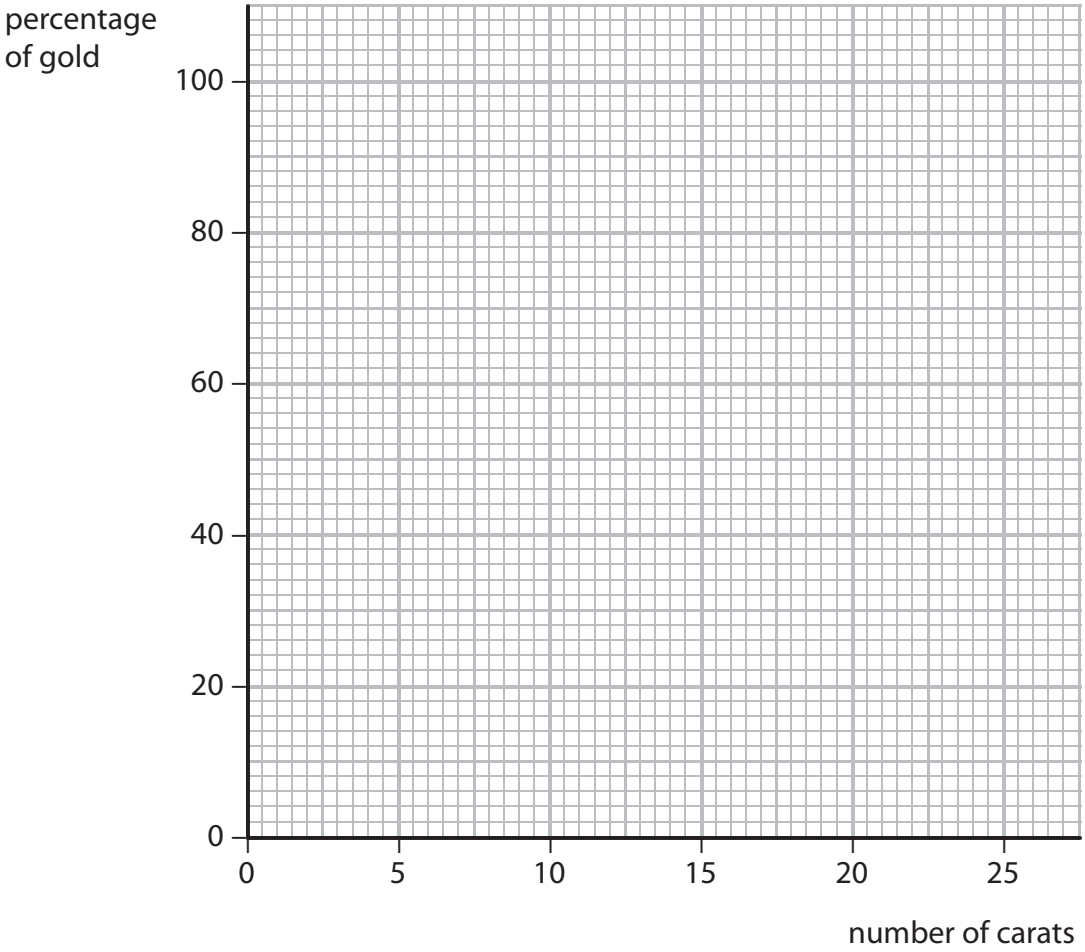
(ii) The purity of gold is often measured in carats.

The data shows how the number of carats is related to the percentage of gold.

number of carats	percentage of gold
24	100
22	92
18	75
9	38

On the grid provided, draw a graph of the percentage of gold against the number of carats.

(2)



(iii) A gold ring is 14 carat gold.

Use the graph to determine the percentage of gold in the ring.

(1)

.....

*(c) Metals are obtained from the Earth's crust by different methods.

Some metals are found uncombined but others have to be extracted from their ores by electrolysis or by heating the ore with carbon.

Explain, using aluminum, gold and iron as examples, how the method used to obtain the metal is related to its position in the reactivity series and to the cost of the extraction process.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2014

Pearson Edexcel GCSE in Chemistry (5CH1H) Paper 01

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Question Number	Answer	Acceptable answers	Mark
1(a)	C oxygen other gases nitrogen		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	A description to include • Photosynthesis /absorb carbon dioxide and releases oxygen (1) • (green) plants (1)	reject respiration for photosynthesis ignore breathe in carbon dioxide ignore breathe out oxygen	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	A description to include second marking is dependent on the first • a glowing splint (1) • relights (1)	smouldering splint reject a blown out splint lit splint glows brighter (2)	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	to ensure all the oxygen is removed/to ensure the oxygen is completely removed	ignore ensure all the air is removed	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	An explanation linking • measure the volume of gas in the syringe at the end of experiment (1) • subtract from {100 cm^3 / original volume} to give volume of oxygen (1)	e.g. 100-79 (= 21 cm^3)	**(2)**

(Total for question 1 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	**C** $CaCO_3$		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	making {glass / concrete / cement / quick lime} / aggregates in road making / extracting iron / neutralising {soil / lake} acidity / neutralising acidic gases in power stations	building materials but not buildings ignore statues	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	A description linking • heat (1) • pressure (1)	compressed/squashed/compacted	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	crystals at A smaller / crystals at B larger / crystals at A small **and** crystals at B big (1)	intrusive rocks form larger crystals/extrusive rocks form smaller crystals	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	A cooled faster /B cooled slower / A cooled fast **and** B cooled slowly (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)	$CaO + H_2O \rightarrow Ca(OH)_2$ (2) LHS (1) RHS (1)	correct multiples ignore state symbols Allow (1) for correct formulae in unbalanced equation	**(2)**

(Total for question 2 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
3(a)	**B** the ease of ignition decreases		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	A description linking either • {carbon monoxide / CO} (1) • is toxic / poisonous (1) or • {carbon / soot / C} (1) • causes respiratory problems /particles blocks jets (1)	 can kill combines with haemoglobin(in place of oxygen) blackens buildings	 **(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	An explanation linking any two of • greenhouse gas (1) • traps heat (in atmosphere) (1) • may lead to increased (global) temperature / global warming (1)	 (increased) greenhouse effect traps infra-red radiation **reject** references to UV increased of global warming e.g climate change **reject** references to ozone layer	 **(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	An explanation linking three from • (sulfur reacts/combusts/burns) with {oxygen/air} (1) • (forms) sulfur dioxide (1) • sulfur dioxide {dissolves/reacts} in {rain/water/clouds} / sulfur dioxide forms acid rain (1) • (acid rain) causes damage to buildings/plants/kills fish in lakes (1)		**(3)**

Question Number	Answer	Acceptable answers	Mark
3(d)	A description including two of the following • biofuels are renewable / fossil fuels are finite/biofuels are sustainable /biofuels will not run out (1) • biofuels are produced from plants (1) • growing plants remove carbon dioxide from the atmosphere (1) • reduces demand for fossil fuels (1) • biofuels do not contain impurities such as sulfur (1)	reject biofuels are reusable ignore carbon neutral alone ignore references to cost	**(2)**

(Total for question 3 = 10 marks)

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	A explanation linking the following • contains carbon (atoms) and hydrogen (atoms) (1) • only (1) • all single bonds/no double bonds (1)	reject carbon molecules and hydrogen molecules ignore no spare bonds	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	**A** remains orange		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	cracking		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	any two reasons from insufficient petrol / supply (from crude oil) (1) higher demand for petrol (1) more fuel oil fraction than needed (1) petrol is more useful than fuel oil (1)	not enough petrol too much fuel oil	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ (3) LHS (1) RHS (1) balancing correct formula (1)	correct multiples ignore state symbols	**(3)**

(Total for question 4 = 10 marks)

Question Number	Answer	Acceptable answers	Mark
5(a)	magnesium nitrate water carbon dioxide all three correct (2) magnesium nitrate + one other correct (1)	allow correct formulae	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	C – neutralisation		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	$ZnO + 2HCl \rightarrow ZnCl_2 + H_2O$ (3) LHS (1) RHS (1) balancing of correct formula (1)	correct multiples ignore state symbols	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A description including some of the following points experiment set up • hydrochloric acid in container • carbon rods in acid • attach rods to electrical supply • d.c. supply(or reference to positive and negative) • test tubes to collect gases test hydrogen • lighted splint • squeaky pop (with air)/burns test chlorine • (damp blue) litmus paper • (turns red then) bleaches/white	**(6)**
Level	**0**	No rewardable content	
1	**1 – 2**	• a limited description e.g. simple description/diagram of electrolysis set up OR description of test for one of the gases. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 – 4**	• a simple description e.g. a full description of electrolysis OR test for both gases OR simple description of electrolysis and the test for one of the gases. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 – 6**	• a detailed description e.g. description of electrolysis and test for both gases OR a full description of electrolysis and of one gas test. • The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for question 5 = 12 marks)

Question Number	Answer	Acceptable answers	Mark
6(a)	**B** tin oxide is reduced		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	An explanation linking two of the following • alloys have different sized atoms • {atoms/layers/sheets/particles} {slide/slip/move} over each other (easily) in pure metal • {structure/layers} disrupted (in alloy) • stop {atoms/layers/sheets/particles} {sliding/slipping/moving} over one another (easily) in	suitable labelled diagrams reject molecules once	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	all points plotted correctly (1) best fit line across 4 plotted points (1)	+/- 1 small square	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b) (iii)	Correct value from their graph +/- one small square (%)		**(1)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	An explanation including some of the following points gold • gold is an unreactive metal/at the bottom of the reactivity series • it does not combine with other elements in the Earth's crust • so is found as uncombined metal • cost of recovery is low iron • iron is a more reactive metal than gold and less reactive than aluminium/middle of reactivity series • found combined with other elements • it is extracted by heating with carbon • electrolysis can be used • but electrolysis is more expensive (than heating with carbon) aluminium • aluminium is a very reactive metal/near to top of the reactivity series • found combined with other elements • it is extracted by electrolysis • because it is very difficult to reduce • electrolysis is a powerful method of reduction • use of electricity makes this method expensive	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. a simple justification in terms of reactivity or cost for how one of the metals is extracted OR an indication of how two of the metals are extracted • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. a simple indication of how all three metals are extracted OR an indication of how two of the metals are extracted with a justification in terms of reactivity or cost for one • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. indicates how all three metals are extracted with a justification for at least two in terms of reactivity and a reference to cost • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for question 6 = 12 marks)

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Write your name here

Surname	Other names

Edexcel GCSE

Centre Number	Candidate Number

Chemistry/Science

Unit C1: Chemistry in Our World

Higher Tier

Thursday 23 May 2013 – Morning **Time: 1 hour**	Paper Reference **5CH1H/01**

You must have: Calculator, ruler	Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 1 9 3 7 A 0 1 2 0

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

P 4 1 9 3 7 A 0 2 2 0
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Questions begin on next page

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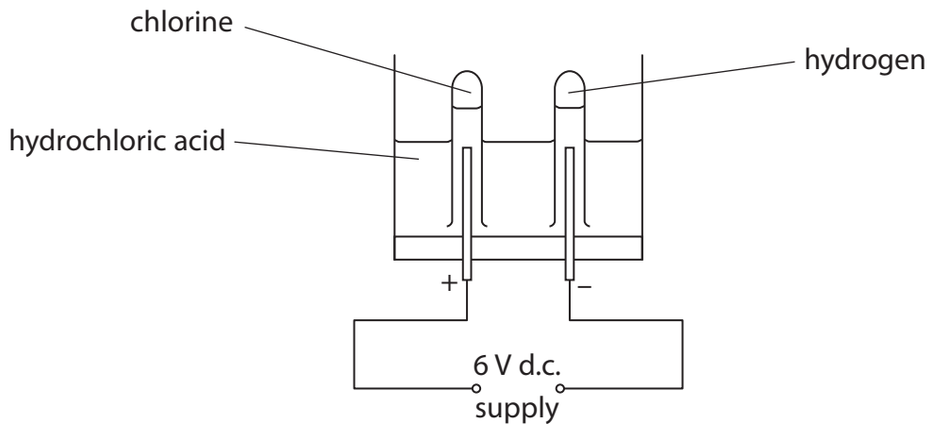
Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Hydrochloric acid

1 (a) Electrolysis of hydrochloric acid produces chlorine and hydrogen.

The apparatus used is shown.



(i) Explain what is meant by **electrolysis**.

(2)

.....

.....

(ii) Describe the test to show that a gas is chlorine.

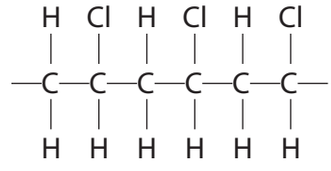
(2)

.....

.....

.....

(iii) Chlorine is used in the manufacture of a polymer.
Part of this polymer molecule is



State the name of the polymer.

(1)

.....

P 4 1 9 3 7 A 0 4 2 0

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(b) Dilute hydrochloric acid reacts with silver nitrate solution to form silver chloride and nitric acid.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The reaction produces silver chloride as a precipitate.
In an equation this would be shown as

(1)

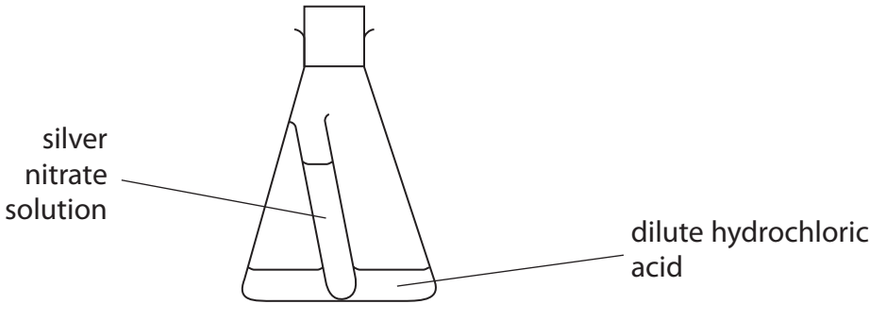
☒ **A** AgCl(aq)

☒ **B** AgCl(g)

☒ **C** AgCl(l)

☒ **D** AgCl(s)

(ii) This apparatus is used to investigate the mass of the reactants and the mass of products in this reaction.



The total mass of this apparatus was measured.
The flask was shaken to allow the silver nitrate solution and dilute hydrochloric acid to react.
After the reaction the total mass of the apparatus was measured again.

State how the total mass of the apparatus after the reaction will compare with the total mass of the apparatus before the reaction.

(1)

.....

(iii) Write the balanced equation for the reaction of silver nitrate solution, $AgNO_3$, with dilute hydrochloric acid to form silver chloride, AgCl, and nitric acid.

(2)

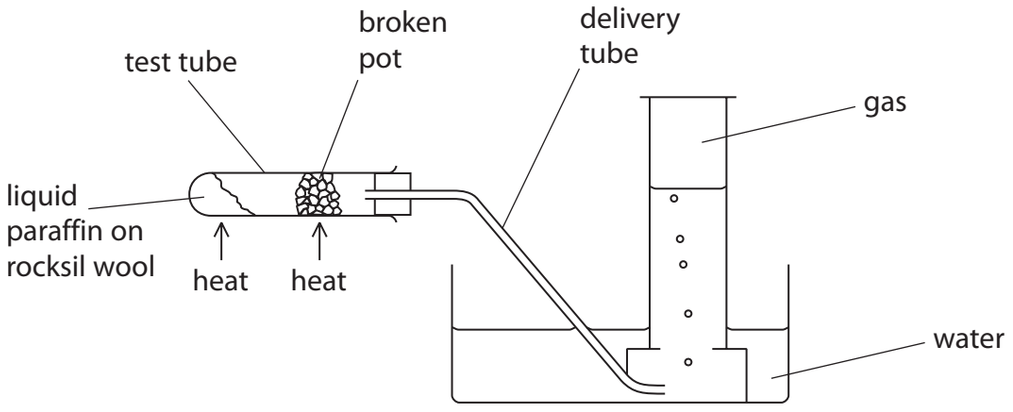
.....

(Total for Question 1 = 9 marks)

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Cracking

2 (a) In the laboratory this apparatus is used to crack long chain hydrocarbon molecules to form shorter chain hydrocarbon molecules.



When the experiment is complete there is a danger that water will rise up the delivery tube into the hot test tube.

State what you would do to prevent this.

(1)

.....

.....

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

The equation for a reaction that occurs during cracking is

$$C_{12}H_{26} \rightarrow C_2H_6 + C_6H_{12} + X$$

In the balanced equation, X is

(1)

☒ **A** C_3H_8

☒ **B** C_4H_8

☒ **C** C_4H_{10}

☒ **D** C_6H_{14}

(c) Alkenes are unsaturated hydrocarbons.

State what is meant by **unsaturated**.

(1)

.....

P 4 1 9 3 7 A 0 6 2 0

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(d) Propane and propene are bubbled through separate samples of bromine water.

Describe what you would **see** in these tests.

(3)

(e) In industry, long chain hydrocarbon molecules are cracked to form shorter chain hydrocarbon molecules.

Explain why this process is important.

(2)

(Total for Question 2 = 8 marks)

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Gases in our atmosphere

3 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

(i) The percentage of carbon dioxide in the Earth's atmosphere today is

(1)

☒ **A** greater than 5%

☒ **B** 4%

☒ **C** 3%

☒ **D** less than 0.5%

(ii) The percentage of carbon dioxide in the Earth's atmosphere today is less than that in the Earth's earliest atmosphere.
Explain what has caused the percentage of carbon dioxide to decrease.

(2)

.....

.....

.....

(iii) Carbon dioxide and other gases in the atmosphere help to keep the Earth warm.
State how these gases keep the Earth warm.

(1)

.....

.....

.....

.....

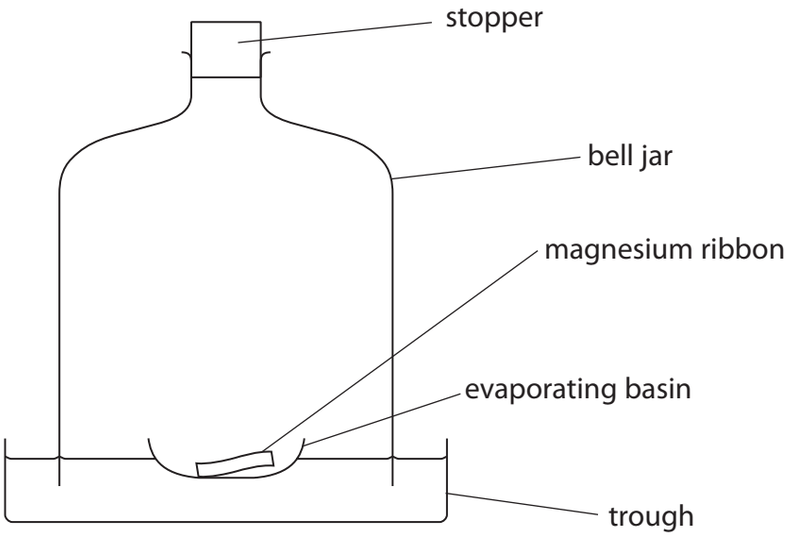
(b) Describe the test to show that a gas is oxygen.

(2)

.....

.....

(c) Magnesium reacts with oxygen to form magnesium oxide.
An excess of magnesium ribbon was placed in an evaporating basin that was floated on water in a trough.
The magnesium ribbon was lit.
A bell jar was placed over the evaporating basin and the stopper inserted to seal the experiment.



When the magnesium flame went out, there was some magnesium left in the basin.
When the apparatus had cooled, the water in the bell jar had risen.

(i) Explain why the water level had risen.

(2)

.....

.....

.....

.....

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(ii) At the start of the experiment, the volume of the air in the bell jar was 1000 cm^3.
Assume that 21% of the air by volume is oxygen.
Calculate the volume of gas that was present in the bell jar at the end of the experiment.

(2)

.....

.....

.....

.....

volume of gas = ... cm^3

(d) Metal oxides react with acids to produce salts and water.
Dilute sulfuric acid was added to magnesium oxide.
State the name of the salt formed.

(1)

.....

(Total for Question 3 = 11 marks)

Aluminium

4 (a) Drinks are often sold in cans.
These cans are made either of aluminium or of steel coated with tin.
The table gives information about these three metallic substances.

metal	cost of 1 kg / £	amount in Earth's crust / %
aluminium	1.31	8
steel (iron)	0.32	5
tin	12.6	0.0002

Use the table to give **two** reasons why it could be more important to recycle tin than to recycle aluminium or steel.

(2)

reason 1

.....

.....

reason 2

.....

.....

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

The reaction for the extraction of aluminium from its ore involves

(1)

☒ **A** heating with carbon

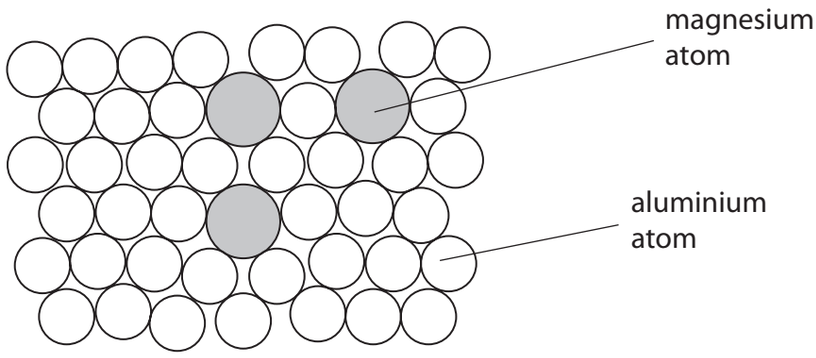
☒ **B** thermal decomposition

☒ **C** reduction

☒ **D** neutralisation

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(c) Magnalium is an alloy of aluminium and magnesium.
The diagram shows the structure of this alloy.



(i) Explain what you understand by the term **alloy**.

(2)

(ii) Explain, in terms of their structures, why magnalium is stronger than pure aluminium.

(3)

(Total for Question 4 = 8 marks)

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Rocks

5 (a) Limestone is a natural form of calcium carbonate.

Explain why calcium carbonate can be used to treat waste gases produced in coal-fired power stations.

(3)

.....

.....

.....

.....

(b) If calcium carbonate is heated strongly it decomposes to calcium oxide and carbon dioxide.

Write the balanced equation for this reaction.

(2)

.....

(c) A few drops of cold water are added to a lump of calcium oxide.

Which of the following is **not** a correct statement about this reaction?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** steam is formed

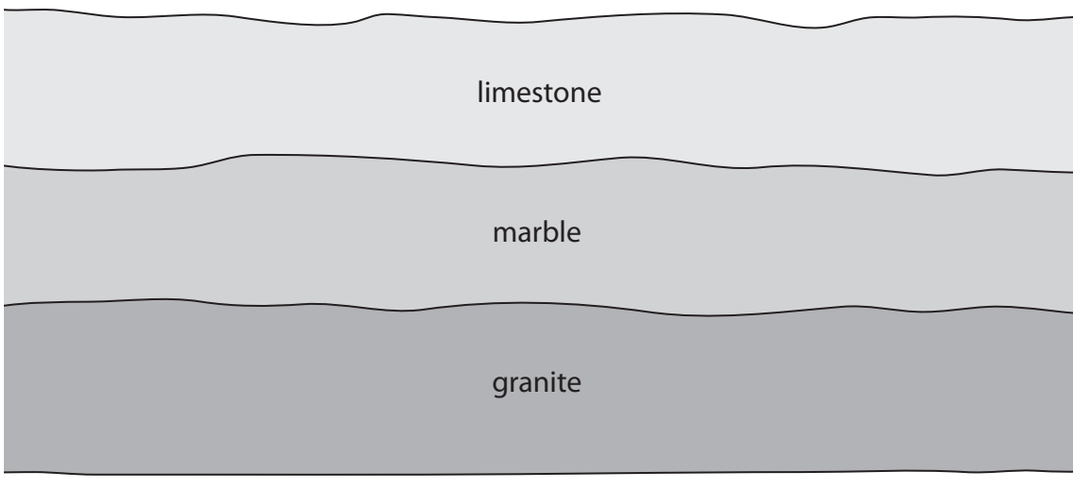
☒ **B** a white powder is produced

☒ **C** the lump of calcium oxide cools down

☒ **D** calcium hydroxide is formed

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*(d) A diagram of rocks under the Earth's surface is shown.



Limestone is a sedimentary rock.
Marble is a metamorphic rock.
Granite is an igneous rock.

Explain how the three rock layers were formed.

(6)

(Total for Question 5 = 12 marks)

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Carbon compounds

6 (a) Which of these is the formula of a molecule of a hydrocarbon?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** CH_3COOCH_3

☒ **B** CH_3CH_2Cl

☒ **C** CH_3CH_3

☒ **D** CH_3COOH

(b) The formula of a molecule of propene is C_3H_6.

Draw the structure of a molecule of propene, showing all covalent bonds.

(2)

(c) Methane burns in oxygen to form carbon dioxide and water.
Write the balanced equation for this reaction.

(3)

P 4 1 9 3 7 A 0 1 6 2 0

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*(d) Natural gas is mainly methane.
A gas with similar composition, known as bio-methane, can be produced from plants grown specifically for this purpose.

Describe the advantages and disadvantages of using bio-methane rather than natural gas as a source of energy.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2013

GCSE Chemistry (5CH1H)
Paper 01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	an explanation linking the following • decomposition (of compound/substance /electrolyte)(1) • using (direct) current (1)	splitting up/breaking down/breaking up ignore separating reject splitting of atoms/elements/molecules for M1 using {electrical energy /electricity} reject alternating current/ac	(2)

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	• (damp blue) litmus (paper) (1) • (turns red then) {bleaches / goes white} (1)	allow bleaches indicator for 1 mark ignore indicator goes lighter ignore smells of chlorine/swimming pools ignore any incorrect middle colour mentioned use of suitable named indicator with correct result e.g. (damp) universal indicator paper (1) (turns red then) bleaches (1) starch-iodide paper(1) turns blue-black(1)	(2)

Question Number	Answer	Acceptable answers	Mark
1(a) (iii)	poly(chloroethene)	PVC/polyvinylchloride/ polychloroethene/poly(chlorethene)	(1)

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	D AgCl(s)		(1)

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	same/no change		(1)

Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	$HCl + AgNO_3 \rightarrow AgCl + HNO_3$ • reactant formulae (1) • product formulae (1)	$Ag^+ + Cl^- \rightarrow AgCl$ max 1 if any incorrect attempt to balance reject incorrect use of cases and non-subscripts	(2)

Question Number	Answer	Acceptable answers	Mark
2(a)	remove delivery tube from water <u>before stopping heating</u>	other words which make sequence clear use of (Bunsen) valve	(1)

Question Number	Answer	Acceptable answers	Mark
2(b)	B C_4H_8		(1)

Question Number	Answer	Acceptable answers	Mark
2(c)	contains a {double/multiple} bond	ignore “spare bonds” ignore reference to number of hydrogen atoms attached.	(1)

Question Number	Answer	Acceptable answers	Mark
2(d)	A description to include • bromine water is orange (1) • propane: (remains) orange / no colour change (1) • propene: becomes colourless /decolourises (1)	 red / yellow / brown any combination of these ignore clear /discolours	(3)

Question Number	Answer	Acceptable answers	Mark
2(e)	An explanation linking any **two** of • shorter chain molecules are more useful ORA (1) • demand for shorter chain molecules ORA (1) • meets demand • reduces the excess of longer chain molecules (1) • (cracking) produces alkenes (1) • alkenes used to make polymers (1)	reject long chain molecules are useless named fraction/use/fuel named fraction /use/fuel	(2)

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	**D** less than 0.5%		(1)

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	A explanation linking any **two** of • dissolves /is absorbed (1) • in the oceans (1) • incorporated into marine organisms (1) • formed carbonate rocks (1) • increase in (green) plants/plants start growing • photosynthesis /plants remove carbon dioxide	reject references to plants respiring/breathing	(2)

Question Number	Answer	Acceptable answers	Mark
3(a)(iii)	traps <u>heat</u>	reflects <u>heat back to Earth</u> reject references to the ozone layer	(1)

Question Number	Answer	Acceptable answers	Mark
3(b)	A description to include • glowing splint (1) M1 • relights (1) M2	smouldering splint reject unlit splint ignore blown out splint M2 dependent on M1 but lighted splint burns brighter (2)	(2)

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	An explanation linking • volume of gas in bell jar decreases/water rises to fill the space (1) • oxygen is removed from the air (1)	{volume/amount} of air decreases accept oxygen is used up	(2)

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	(amount of gases remaining) 79% (1) (volume remaining) = $\frac{1000 \times 79}{100}$ (1) = 790 (cm^3)	ecf for incorrect percentage of volume of gases remaining in M1 correct answer or valid calculation alone scores (2)	(2)

Question Number	Answer	Acceptable answers	Mark
3(d)	magnesium sulphate	accept magnesium sulphate	(1)

Question Number	Answer	Acceptable answers	Mark
4(a)	• tin {more expensive/costs more} (than aluminium/steel) ORA (1) • amount of tin in Earth smaller (than aluminium/steel) ORA (1)	rarer	(2)

Question Number	Answer	Acceptable answers	Mark
4(b)	C - reduction		(1)

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	an explanation linking the following • a mixture of (1) • metals (1)	reject compound ignore combined/joined specific examples reject reference to non-metals metals melted together (2)	(2)

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	an explanation linking any **three** of • in pure metal /aluminium atoms are all same size (1) • in pure metal /aluminium {layers/sheets/atoms} {slide/slip/move} (over one another) easily(1) • magnesium atoms larger (1) • disrupt {layers/structure/arrangement} of aluminium atoms (1) • prevent {layers/sheets/atoms} {slip/slide/move} (1)	ions or particles for atoms reject molecules once only different sized particles {lock/hold/jam} layers together	(3)

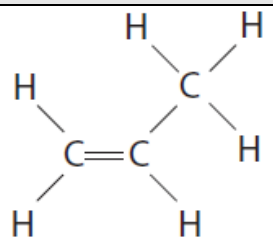
Question Number	Answer	Acceptable answers	Mark
5(a)	an explanation linking any **three** of • (removes waste) gases that are acidic • contain sulfur dioxide (1) • (produced from) sulfur impurities in coal (1) • (limestone/calcium carbonate) {reacts with/neutralises} (gases)(1)	{limestone/calcium carbonate} is a base (1) ignore limestone/calcium carbonate is an alkali	(3)

Question Number	Answer	Acceptable answers	Mark
5(b)	$CaCO_3 \rightarrow CaO + CO_2$ • reactant formula (1) • product formulae (1)	max 1 if any incorrect attempt to balance reject incorrect use of cases and non-subscripts	(2)

Question Number	Answer	Acceptable answers	Mark
5(c)	C – the lump of calcium oxide cools down		(1)

Question Number		Indicative content	Mark
QWC	***5(d)**	An explanation linking some of the following **limestone** • formed from sediments/shells • sediments fall to bottom of sea • layers of sediments build up • long time period • compaction • by pressure • rocks appear out of the sea **granite** • magma /molten rock • forced up • cools • solidifies • intrusive rock • forms crystals **marble** • limestone {changed/metamorphosed} • by heat • (from) magma/molten rock • and pressure	(6)
Level	**0**	No rewardable content	
1	**1-2**	• a limited explanation e.g. limestone formed from sediments on the sea bed. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• a simple explanation e.g sediments compacted to form limestone which is changed by heat and pressure into marble. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation e.g. limestone formed from sediments . Molten rock /magma cools to form granite. The heat and pressure change the limestone into marble. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)	C – CH_3CH_3		

Question Number	Answer	Acceptable answers	Mark
6(b)		carbon skeleton correct including double bond (1) rest of molecule correct (1) allow CH_3	(2)

Question Number	Answer	Acceptable answers	Mark
6(c)	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ • reactant formulae (1) • product formulae (1) • balancing of correct formulae (1)	accept multiples reject incorrect use of cases and non-subscripts	(3)

Question Number		Indicative content	Mark
QWC	***6(d)**	advantages • renewable / sustainable • more plants can be grown • crops use up carbon dioxide and produce oxygen when growing /photosynthesising • carbon neutral because the carbon produced during combustion is used when growing the plants • does not use up crude oil/non-renewable resources disadvantages • crops grown for bio-fuels use up land • land could otherwise be used to provide homes / less farmland available for growing food crops • lots of crops required to provide a small amount of bio-methane • bad season reduces availability • carbon emissions due to transport and production if qualified	(6)
Level	**0**	No rewardable content	
1	**1-2**	• a limited description e.g. using bio-methane conserves fossil fuels and uses up carbon dioxide when plants are grown • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, puncuation and grammar are used with limited accuracy	
2	**3-4**	• a simple description e.g. growing plants to produce bio-methane is sustainable and conserves fossil fuels but uses up lots of farm land which could be used to grow plants for food • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, puncuation and grammar are used with some accuracy	
3	**5 - 6**	• detailed description e.g growing plants remove carbon dioxide from the air during photosynthesis and conserves fossil fuels but lots of crops are required to make bio-methane and this uses up farm land which could otherwise be used to grow crops for food • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, puncuation and grammar are used with few errors	

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Edexcel GCSE

Centre Number	Candidate Number

Chemistry/Science

Unit C1: Chemistry in Our World

Higher Tier

Tuesday 5 March 2013 – Morning **Time: 1 hour**	Paper Reference **5CH1H/01**

You must have: Calculator, ruler	Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

P 4 1 9 6 3 A 0 2 1 6
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Questions begin on next page.

Answer ALL questions

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The atmosphere

1 A student used the internet to find information about the percentages of different gases in the Earth's early atmosphere.
She was surprised to find the information given on two websites was very different.

The information from the two websites is shown in the table.

website 1		website 2	
gas	**percentage gas in atmosphere (%)**	**gas**	**percentage gas in atmosphere (%)**
hydrogen	60	carbon dioxide	92.2
water vapour	20	nitrogen	5.1
carbon dioxide	10	sulfur dioxide	2.3
hydrogen sulfide	6	hydrogen sulfide	0.2
nitrogen	3	ammonia	0.1
methane	1	methane	0.1

(a) One of the gases in the table is present in a much larger amount in today's atmosphere.

State the name of this gas.

(1)

.....

(b) A gas not named in the table makes up about 21% of today's atmosphere.

State the name of this gas.

(1)

.....

(c) Complete the sentence by putting a cross (☒) in the box next to your answer.

The amount of carbon dioxide in the early atmosphere was reduced by

(1)

☒ **A** animals breathing

☒ **B** volcanic activity

☒ **C** deforestation

☒ **D** the gas dissolving in oceans

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(d) The information given on two websites is very different.

Explain why it is difficult to be certain about the composition of the Earth's early atmosphere.

(2)

.....

.....

.....

.....

(e) In an experiment to find the percentage of oxygen in the air, some copper was heated in 50.0 cm^3 of dry air.

All of the oxygen in this sample of air reacted to form copper oxide.

After the reaction, the volume of gas remaining was 41cm^3.

(i) Calculate the percentage of oxygen in this sample of air.

(2)

% oxygen = ...

(ii) The word equation for the reaction is

copper + oxygen → copper oxide

Balance the equation for this reaction by putting numbers in the spaces provided.

(1)

.....Cu + O_2 → .....CuO

(Total for Question 1 = 8 marks)

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Rocks and their uses

2 (a) Igneous, metamorphic and sedimentary are the three different types of rock.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

An example of a metamorphic rock is

(1)

☒ **A** chalk

☒ **B** granite

☒ **C** limestone

☒ **D** marble

(ii) The photograph shows a sample of rock.



Explain which of the three types of rock this is most likely to be.

(2)

.....

.....

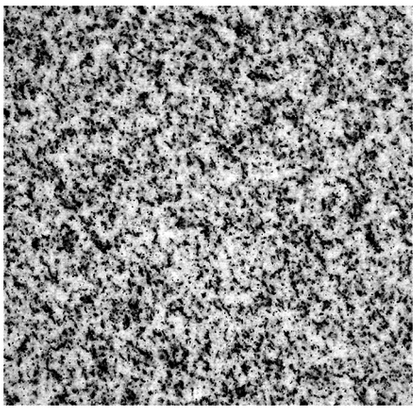
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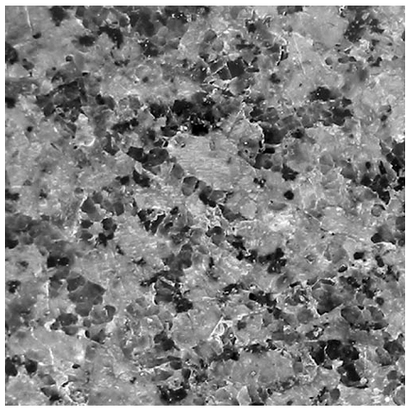
P 4 1 9 6 3 A 0 6 1 6

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(b) The photographs show the crystals in two samples of igneous rock, A and B.



rock A



rock B

Explain how these igneous rocks, containing different sized crystals, have been formed.

(3)

(c) Limestone is mainly calcium carbonate.

Explain why calcium carbonate is used to treat waste gases produced in coal-fired power stations.

(3)

(Total for Question 2 = 9 marks)

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Crude oil and biofuels

3 (a) Gases, petrol, kerosene, diesel oil, fuel oil and bitumen are the fractions obtained from crude oil by fractional distillation.

Identify the fraction described in each of the following statements.

(i) This fraction is more difficult to ignite than most other fractions and is used as a fuel in large ships.

(1)

name of fraction .....

(ii) This fraction is obtained from the top of the fractionating column.

(1)

name of fraction .....

(iii) This fraction has a higher boiling point than kerosene and is used as a fuel for some cars.

(1)

name of fraction .....

(b) When hydrocarbon fuels are burnt, several different products can be formed.

Which of these cannot be a product of burning hydrocarbon fuels?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** carbon

☒ **B** carbon dioxide

☒ **C** hydrogen

☒ **D** water

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(c) Carbon monoxide gas, CO, can be formed when methane, CH_4, undergoes incomplete combustion.

(i) Balance this equation for the incomplete combustion of methane by putting numbers in the spaces provided.

(2)

$$2CH_4 + \ldots\ldots O_2 \rightarrow 2CO + \ldots\ldots H_2O$$

(ii) Carbon monoxide is a toxic gas and can cause death.

Explain how carbon monoxide can cause death.

(2)

.....

.....

.....

.....

(d) Biofuels are produced from plants.

Explain a problem caused by growing plants to produce biofuels.

(2)

.....

.....

.....

.....

(Total for Question 3 = 10 marks)

Acids and electrolysis

4 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

An acid reacts with a metal oxide to form

(1)

☒ **A** a salt and hydrogen only

☒ **B** a salt and oxygen only

☒ **C** a salt only

☒ **D** a salt and water only

(b) Acids also react with metal carbonates.

The word equation for the reaction of copper carbonate with dilute nitric acid is

copper carbonate (s) + nitric acid (aq) → copper nitrate (aq) + carbon dioxide (g) + water (l)

(i) State **two** things you would **see** when solid copper carbonate reacts with dilute nitric acid.

(2)

.....

.....

.....

(ii) Write the balanced equation for the reaction of copper carbonate with dilute nitric acid.

(3)

.....

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(c) Two gases can be produced by the electrolysis of water, under suitable conditions.

(i) Explain what is meant by **electrolysis**.

(2)

(ii) One of the gases is oxygen.

Describe a test to show the gas is oxygen.

(2)

(Total for Question 4 = 10 marks)

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Metals and alloys

5 Gold is used to make some jewellery.

(a) Explain why gold is used to make jewellery.

(2)

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

The purity of gold can be measured in carats.

Pure gold is

(1)

☒ **A** 9 carat

☒ **B** 18 carat

☒ **C** 24 carat

☒ **D** 100 carat

(c) Gold can be alloyed with other metals to produce alloys that have a higher strength than pure gold.

Explain why gold alloys are stronger than gold.

(3)

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*(d) Iron and aluminium occur in the Earth's crust as their oxides.

Different methods are used to extract iron and aluminium from their oxides.

Explain, in terms of the position of the metal in the reactivity series and the cost of the extraction processes, why iron and aluminium are extracted by different methods.

(6)

(Total for Question 5 = 12 marks)

Polymers and alternative fuels

6 Polymers can be made from alkenes.

(a) Which of the following statements about alkenes is correct?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** alkenes turn bromine water orange

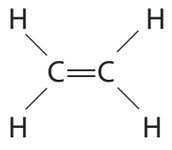
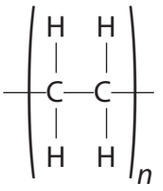
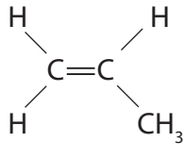
☒ **B** alkenes have a double bond between two hydrogen atoms

☒ **C** alkenes are unsaturated hydrocarbons

☒ **D** alkenes can undergo complete combustion to produce carbon monoxide

(b) The table shows two monomers and the polymers they form.

Complete the table.

monomer structure	name of polymer formed	polymer structure
		
	poly(propene)	

(2)

P 4 1 9 6 3 A 0 1 4 1 6

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(c) A number of methods are used to dispose of waste polymers.

Explain a problem caused by the disposal of polymers.

(2)

*(d) Most of the energy we require comes from burning fossil fuels.
The supply of fossil fuels is limited and therefore other fuels are needed.

Various fuels are being tested.

Explain the properties required of a good fuel.

(6)

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

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GCSE Chemistry
5CH1H/01

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Question Number	Answer	Acceptable answers	Mark
1(a)	nitrogen	Name only	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	oxygen	Name only	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)	D (the gas dissolving in oceans)		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)	An explanation linking two of: • no humans on Earth (1) • no measurements taken (1) • different sources conflict (1) • websites may refer to different times (1)	 no evidence/data/records (gases in) ice core or rock data not old enough Ignore little/insufficient/limited evidence websites can be wrong Ignore websites can give different information	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(e)(i)	50 – 41 (1) M1 (= 9) 9/50 x 100 (1) M2 (= 18)	 ECF from M1 give full marks for correct answer with no working If 82% allow 1 mark out of 2	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(e)(ii)	$2\ Cu + O_2 \rightarrow 2\ CuO$	any multiples of all the equation eg $4\ Cu + 2O_2 \rightarrow 4\ CuO$	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	D marble		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	An explanation linking • sedimentary (1) M1 • (contains) **fossils** (1) M2	 M2 independent of M1 fossils unlikely to exist in igneous/metamorphic rocks	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	An explanation linking any three of the following • magma/lava/molten rock (1) M1 • cools (1) M2 • (A cools) quickly to form small crystals (1) M3 • (B cools) slowly to form large crystals(1) M4	 If no reference to magma/lava/molten rock max 2 marks reference to reason for different rates of cooling e.g. (rock A forms) on surface/extrusive so small crystals e.g. (rock B forms) underground/intrusive so large crystals	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(c)	An explanation linking three of: • (waste) **gases** acidic (1) M1 • calcium carbonate basic (1) M2 • (calcium carbonate) reacts with/neutralises/forms (correctly named) salt with *(*waste acidic gases*)* (1) M3 • coal contains sulfur (impurity) (1) M4 • (burns to form) sulfur dioxide (1) M5 • sulfur dioxide causes acid rain M6 • (calcium carbonate) reduces acid rain (1) M7	Ignore harmful gases Ignore alkali(ne) Ignore absorbs/eliminates Only credit causes acid rain if sulfur dioxide mentioned	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	fuel oil		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	gases	gas	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(iii)	diesel oil	diesel	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	C hydrogen		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	• $2CH_4$ + **<u>3</u>** O_2 (1) • $2CO$ + **<u>4</u>** H_2O (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	An description linking • (carbon monoxide) combines with haemoglobin/red blood cells (1) • lack of **oxygen** (to brain/cells) (1)	forms carboxyhaemoglobin reacts with/joins (on to) haemoglobin so less/no **oxygen** can be carried carbon monoxide replaces **oxygen** Ignore suffocation	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)	An explanation linking two of • uses up (farm)land/space/area (to grow crops for fuel) (1) M1 • less (farm)land to grow crops for **food** (1) M2 • can cause food prices to rise (1) M3 • (could lead to) food shortages/famine/starvation/ poverty (1) M4 • (could lead to) deforestation/soil erosion (1) M5	less **food** produced/grown Ignore reference to habitats Ignore decrease in biodiversity Ignore reference to carbon dioxide levels/greenhouse effect	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)	D a salt and water only		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	A description including two of • (acid) colourless (liquid/solution) (1) • (carbonate) green (solid) (1) • disappears (1) • effervesces/fizzes/bubbles (1) • blue (solution) (forms) (1)	Ignore clear dissolves Ignore gas/carbon dioxide given off	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	$CuCO_3 + 2HNO_3 \rightarrow Cu(NO_3)_2 + H_20 + CO_2$ reactants (1) products (1) balancing of correct formulae (1)	multiples	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	An explanation linking • decomposition (of compound/substance) (1) M1 • (by) (direct electric) current (1) M2	splitting up/breaking down/breaking up (of compound/substance) Reject splitting of atoms/elements for M1 Ignore separating (by) electricity/electrical energy/direct current Reject alternating current/ac	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	A description linking • glowing splint (1) M1 • relights (1) M2	 smouldering splint Reject unlit (splint) Ignore blown out (splint) M2 dependent on M1 but lighted splint burns brighter = 2	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)	An explanation including two of • does not corrode/tarnish (1) M1 • unreactive (1) M2 • shiny/lustrous (1) M3 • malleable/easily shaped (1) M4 • scarce/expensive/maintains its value (1) M5	 Ignore does not rust does not react with oxygen and/or water Ignore least reactive/less reactive/not very reactive/reacts very slowly attractive Ignore soft/strong valuable	**(2)**

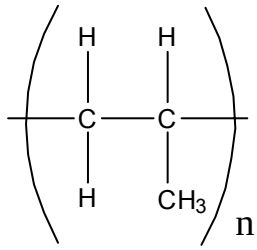
Question Number	Answer	Acceptable answers	Mark
5(b)	C 24 carat		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(c)	An explanation linking three of • (gold) atoms all same size (1) M1 • {layers/sheets} (of atoms) {slide/slip/move} M2 (over one another easily) (1) • (alloy) added metals atoms are different size (1) M3 • disrupt{layers/structure/arrangement} of gold atoms (1) M4 • prevent {layers/atoms} {slide/slip/move} (1) M5	Marks can be gained from suitable diagrams No mention of layers/sheets in answer maximum 2 marks Accept particles/ions for atoms reject molecules (once only) {lock/hold} layers/atoms together	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(d)**	An explanation including some of the following points **reactivity series** • aluminium more reactive than iron/aluminium higher than iron in reactivity series • aluminium forms stronger bonds with oxygen than iron does • aluminium oxide more stable (to decomposition) than iron oxide • aluminium more reactive than carbon/aluminium higher than carbon in reactivity series **cost** • electrolysis/electricity (more) expensive (than heating with carbon) • heating with carbon is (relatively) cheap method **Iron** • carbon more reactive than iron/iron less reactive than carbon • iron oxide reduced • by heating with carbon • no need to use (expensive) electrolysis • **Aluminium** • aluminium oxide difficult to reduce • aluminium oxide cannot be reduced by (heating with) carbon • (cheaper) reduction with carbon does not work • need more powerful method of reduction • therefore must use electrolysis	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. aluminium is very reactive e.g. aluminium extracted by electrolysis e.g. iron extracted using carbon e.g. costs more to extract aluminium • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	

2	**3 - 4**	• a simple description containing two statements referring to one method of extraction and a cost e.g. iron is extracted by heating iron oxide with carbon and this is cheaper OR the relative reactivity of one metal and a method of extraction e.g. aluminium is extracted by electrolysis. Aluminium is more reactive than iron (has made a comparison in reactivity) OR the relative reactivity of one metal and reference to cost e.g. aluminium is a more reactive metal and so is expensive to extract • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed description containing at least three statements referring to relative reactivity of both metals, a method of extraction of at least one metal, and a cost reference e.g. aluminium is more reactive than iron so is extracted by electrolysis which is expensive • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Question Number	Answer	Acceptable answers	Mark
6(a)	C alkenes are unsaturated hydrocarbons		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	poly(ethene) (1)  (1)	polythene/polyethylene continuation bonds need not go through brackets Allow bond pointing to any part of CH_3	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(c)	An explanation linking two of non biodegradable (1) persist in landfill sites (1) OR produce gases/fumes when **burnt** (1) M1 gases may be toxic/harmful (1) M2 OR cannot be recycled (1) new {raw material/crude oil} needed (1)	 {do not/take (very) long time to} decompose/rot/disintegrate/degrade stays for long time take up a lot of space (in landfill sites) a named gas linked to the environmental problem it causes e.g. carbon dioxide is a greenhouse gas Ignore pollutants (need to use) finite resources	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	An explanation including some of the following points A good fuel should **Burning considerations** • ignite easily • burn easily • release a lot of /sufficient heat energy when it is burnt **Usage considerations** • be safe to use • be safe/easy to transport • be {safe/easy/convenient} to store • be reasonably cheap **Supply considerations** • readily available/good supply • be renewable/sustainable/not finite **Products considerations** • not produce (much) solid/ash when burnt • not produce much/any smoke • contain little/no sulfur • not produce {toxic/harmful} gases/fumes • carbon neutral • not produce too much carbon dioxide or other named gas such as sulfur dioxide or greenhouse gases	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description covering two aspects: e.g. burn easily and safe to use **OR** one aspect covered in more detail e.g. is cheap and easy to transport the answer communicates ideas using simple language and uses limited scientific terminology, spelling, punctuation and grammar are used with limited accuracy	

2	**3 - 4**	• a simple description covering three aspects e.g. burn easily, safe to use and readily available **OR** one aspect covered simply and one covered in more detail e.g. is cheap, easy to store and transport and ignites easily • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed description covering four aspects e.g. burn easily, safe to use and transport, renewable and does not produce harmful gases **OR** three aspects with one in depth e.g. ignites easily, produces large amounts of energy and produces no smoke and can be easily transported • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

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Edexcel GCSE

Centre Number	Candidate Number

Chemistry/Science

Unit C1: Chemistry in our World

Higher Tier

Wednesday 7 November 2012 – Morning **Time: 1 hour**	Paper Reference **5CH1H/01**

You must have: Calculator, ruler	Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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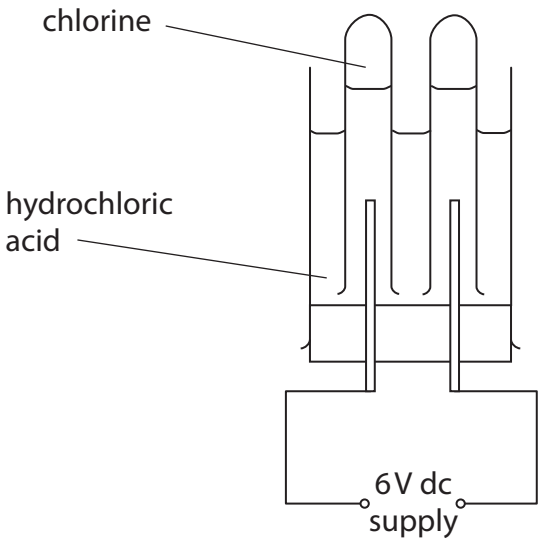
Questions begin on next page.

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Hydrochloric acid and chlorine

1 (a) Hydrochloric acid can be electrolysed using this apparatus.



(i) State the form of energy used to carry out the electrolysis.

(1)

.....

(ii) Chlorine gas is formed at one electrode.

Name the gas formed at the other electrode.

(1)

.....

(iii) Describe the test to show that a gas is chlorine.

(2)

.....

.....

.....

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(b) Which of these can be used to obtain chlorine from sea water?

Put a cross (☒) in the box next to your answer.

(1)

- ☐ **A** corrosion
- ☐ **B** electrolysis
- ☐ **C** fractional distillation
- ☐ **D** neutralisation

(c) Acids react with metal carbonates.

Complete the word equation for this type of reaction.

(1)

acid + metal carbonate → salt + water + ...

(d) Acids also react with metal oxides.

Complete and balance the equation for the reaction between copper oxide, CuO, and dilute hydrochloric acid, HCl.

(2)

$$CuO + \text{.....} HCl \rightarrow CuCl_2 + \text{.....}$$

(Total for Question 1 = 8 marks)

Fuels

2 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

Crude oil is a mixture of mainly

(1)

- ☒ **A** alkenes
- ☒ **B** carbon and hydrogen
- ☒ **C** hydrocarbons
- ☒ **D** polymers

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

Fuel oil is used as a fuel in

(1)

- ☒ **A** aircraft engines
- ☒ **B** car engines
- ☒ **C** cooking stoves
- ☒ **D** power station furnaces

(c) (i) Methane, CH_4, is a gas that can be used as a fuel.

During complete combustion, it burns in oxygen to produce carbon dioxide and water.

Write the balanced equation for the complete combustion of methane.

(3)

(ii) The table shows the amount of heat energy produced when different masses of methane and octane are burnt.

fuel	mass burnt / g	heat energy released / kJ
methane	16	896
octane	114	5472

When 1 g of methane is burnt, 56 kJ of heat energy is produced.

Calculate the heat energy produced when 1 g of octane is burnt.

(1)

.....

.....

heat energy produced = ... kJ

(iii) State **two** factors that make a good fuel.

(2)

.....

.....

.....

.....

(Total for Question 2 = 8 marks)

Carbon dioxide

3 (a) Which of these shows the relative amounts of carbon dioxide and oxygen in the Earth's early atmosphere?

(1)

Put a cross (☒) in the box next to your answer.

☐ **A** large amount of carbon dioxide and large amount of oxygen

☐ **B** large amount of carbon dioxide and small amount of oxygen

☐ **C** small amount of carbon dioxide and large amount of oxygen

☐ **D** small amount of carbon dioxide and small amount of oxygen

(b) The concentration of carbon dioxide in the Earth's atmosphere depends on the balance between the processes that remove carbon dioxide from the atmosphere and those that release carbon dioxide into the atmosphere.

(i) Explain how carbon dioxide is removed from the atmosphere.

(2)

(ii) Explain how carbon dioxide is released into the atmosphere.

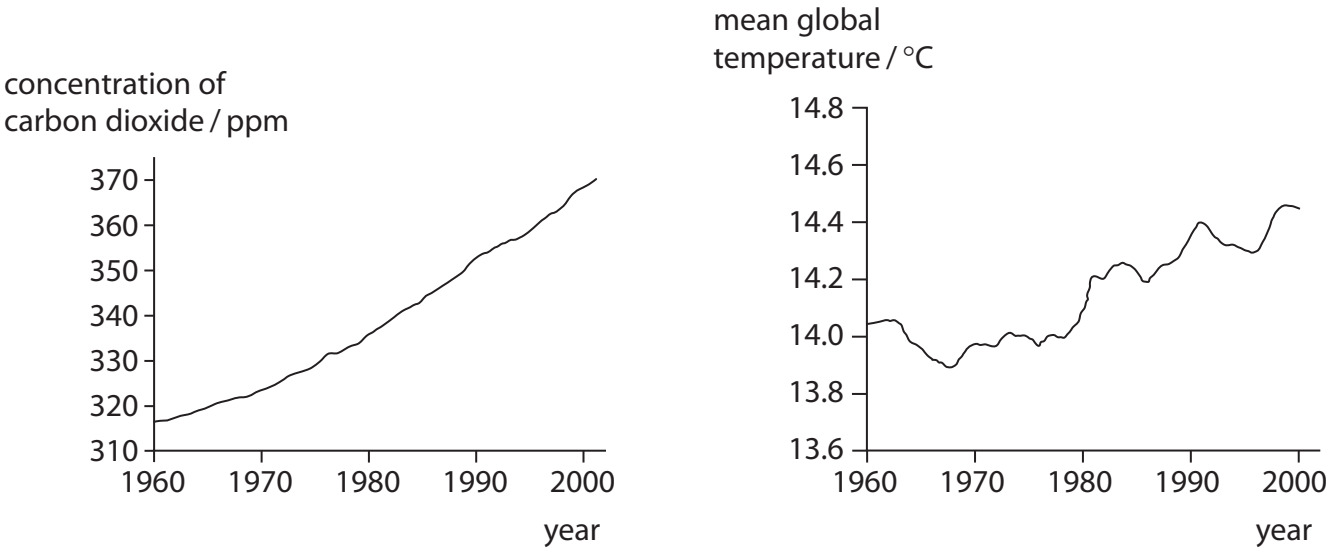
(2)

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(c) Describe the test to show that a gas is carbon dioxide.

(2)

(d) The graphs show the concentration of carbon dioxide in the atmosphere and the mean global temperature between 1960 and 2000.



Explain whether or not these graphs provide evidence that human activity is causing the Earth's temperature to rise.

(3)

(Total for Question 3 = 10 marks)

Calcium carbonate

4 (a) Marble and limestone are both forms of calcium carbonate.

Which of the following is a rock that is another form of calcium carbonate?

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** chalk
- ☒ **B** glass
- ☒ **C** granite
- ☒ **D** magma

(b) When calcium carbonate is heated strongly it undergoes thermal decomposition.

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

2.50 g of calcium carbonate was heated strongly.

1.40 g of solid remained after heating.

(i) Calculate the mass of carbon dioxide produced during this reaction.

(1)

.....

mass of carbon dioxide = ... g

(ii) It is possible that not all of the calcium carbonate decomposed when it was heated.

Suggest what could be done to confirm that the decomposition was complete.

(2)

.....

.....

.....

(iii) Calcium oxide reacts with water to form calcium hydroxide.

Write the balanced equation for this reaction.

(2)

.....

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(c) In an experiment, calcium chloride solution reacted with sodium carbonate solution to produce solid calcium carbonate and sodium chloride solution.

$$CaCl_2(aq) + Na_2CO_3(aq) \rightarrow CaCO_3(s) + 2NaCl(aq)$$

mass of calcium chloride solution used = 11.00 g

mass of sodium carbonate solution used = 10.50 g

mass of calcium carbonate solid produced = 1.00 g

Calculate the mass of the solution left at the end of the reaction.

(2)

.....

.....

mass of remaining solution = ... g

(d) Calcium carbonate is used to treat waste gases produced in coal-fired power stations.

Explain why calcium carbonate is used in this way.

(2)

.....

.....

.....

.....

.....

.....

(Total for Question 4 = 10 marks)

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Metals

5 This is part of the reactivity series of metals.

most reactive	magnesium
	aluminium
	zinc
	iron
	copper
	silver
least reactive	gold

(a) Iron is extracted by the reduction of iron oxide.

In the extraction process, iron oxide is reduced by heating it with carbon.

(i) The extraction process involves both reduction and oxidation reactions.

State what is oxidised in this process.

(1)

.....

.....

(ii) Aluminium is extracted from its oxide by electrolysis.

Explain why iron can be extracted from iron oxide by heating it with carbon but electrolysis has to be used to extract aluminium from its oxide.

(2)

.....

.....

.....

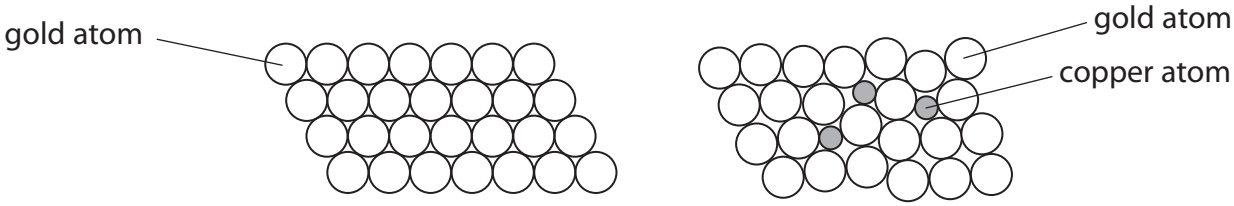
.....

(b) The photograph shows a mask discovered in Colombia.

It is made from a gold and copper alloy.



The diagrams show the structure of pure gold and of the alloy containing a few atoms of copper.



Explain how the presence of copper atoms results in an alloy with a higher strength than pure gold.

(3)

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*(c) Metals have specific uses based on their properties.

The table shows some properties of four metals.

metal	cost of 1 kg / £	density / g cm^{-3}	relative strength	resistance to corrosion	electrical conductivity
aluminium	1	2.70	high	good	good
copper	5	8.92	high	good	very good
gold	33000	19.3	low	excellent	excellent
silver	620	10.5	low	very good	excellent

Use the data in the table to explain some uses of each of these metals in relation to their individual properties.

(6)

(Total for Question 5 = 12 marks)

Propene

6 Propene is an alkene.

The formula of its molecule is C_3H_6.

(a) (i) Draw the structure of a propene molecule, showing all of the bonds.

(2)

(ii) One molecule of decane, $C_{10}H_{22}$, can be cracked to produce one molecule of propene and one molecule of an alkane **X** only.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The formula of a molecule of alkane **X** is

(1)

☒ **A** C_7H_{14}

☒ **B** C_7H_{16}

☒ **C** C_8H_{16}

☒ **D** $C_{13}H_{28}$

(b) Propane is an alkane.

Propane and propene are both gases.

Given a sample of each gas, describe a test to show which gas is propane and which gas is propene.

(3)

*(c) Propene is used to make the polymer poly(propene).

Explain how poly(propene) molecules are formed from propene molecules and relate the properties of poly(propene) to its uses.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

November 2012

GCSE Chemistry
5CH1H/01

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GCSE Chemistry 5CH1H/01 Mark Scheme – November 2012

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	electrical (energy) / electricity / direct (electric) current	**Reject** {ac/ alternating current}	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	hydrogen	H_2	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	A description including (damp blue or red) litmus (paper)) (turns red and) bleached / white)	**Allow** use of any suitable indicator (1) with correct result (1) eg Universal Indicator (1) is bleached (1) starch-iodide paper (1) turns blue-black (1) **Allow** bleaches indicator (1) **Do not allow** colourless for {bleached/white} if indicator paper is used **Ignore** indicator gets lighter **Ignore** any incorrect middle colour mentioned **Ignore** smells of swimming pools	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)	**B** electrolysis		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)	carbon dioxide	CO_2	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)	$CuO + \mathbf{2}\ HCl \rightarrow CuCl_2 + \mathbf{H_2O}$ 2 (1) H_2O (1) Maximum 1 mark if additional incorrect balancing	**Reject** obvious incorrect symbols and subscripts eg h_2O (0) H^2O (0) H_2o (0) H2O (0) **Ignore** state symbols	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)	**C** hydrocarbons		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	**D** power station furnaces		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ correct formulae on left $CH_4 + O_2$ (1) correct formulae on right $CO_2 + H_2O$ (1) balancing of correct formulae(1)	**Allow** multiples or halves **Allow** = for → **Reject** obvious incorrect symbols and subscripts once only	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	48 (kJ) (1) or 5472 /114 = 48 (kJ) (1) or 5472/114 (1)		**(1)**

Question	Answer	Acceptable answers	Mark

Number			
2(c)(iii)	Any two of easy to ignite / low boiling point / low viscosity (1) {burns readily/easily} / (in)flammable(1) not produce too much {soot/ash/ smoke} / burns with {clean/blue} flame / burns cleanly (1) easy to {store/contain} (1) easy to {transport/transfer} (1) high energy output per unit {mass /volume} (1) does not produce {toxic gases/carbon dioxide/sulfur dioxide/greenhouse gases} / contains a low amount of sulfur (1) fuel is {readily available/easy to obtain/will not run out/long lasting/renewable} (1) carbon neutral (1)	**Ignore** burns for a long time **Ignore** just 'releases a lot of energy' **Ignore** references to cost **Ignore** vague answers eg doesn't cause pollution/harmful gases **Ignore** answers written in the form of questions or statements that do not show a characteristic of a **good** fuel eg how easy is it to ignite the fuel? how much energy it produces **Allow** a little produces a lot of energy **Allow** produces a lot of {miles/km} per {gallon/litre}	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)	**B** large amount of carbon dioxide and small amount of oxygen		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	**Both marks must come from the same pair only, not one from each pair** An explanation linking EITHER plants (1) photosynthesis / take in carbon dioxide and release oxygen (1) OR oceans / rain /seas /water (1) {dissolve/absorb/take in} gas (1)	**Allow** convert to hydrocarbon (1) iron seeding (1) **Reject** respiration for photosynthesis **Ignore** breathe in carbon dioxide **Ignore** carbon is locked up in rocks	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	**Both marks must come from the same pair only, not one from each pair** An explanation linking burning/ (complete) combustion(1) (fossil) fuels/wood/rubbish/plastic etc (1) or plants/animals/organisms (1) respiration / gas exhaled / breathing / decaying (1) or volcanic activity/volcanoes (1) eruption (releases gas) (1)	**Ignore** just 'deforestation' **Ignore** just 'farming' **Allow** any type of fuel except hydrogen **Allow** heating limestone (2)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	A description including limewater (1) turns milky/cloudy/white ecipitate (1)	 **Ignore** heat **Reject** observation if incorrect reagent eg bromine water or water	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)	**All marks must come from the same section only, do not mix and match** An explanation linking: EITHER **First 2 marking points** concentration of carbon dioxide increases (steadily) (1) but the temperature {fluctuates/increases and decreases} (1) **Third marking point** dependent on at least 1 comment from a graph any 1 from: not all carbon dioxide is produced by human activity (1) none of the graphs refer to human activity (1) there is no proof that human activity causes the temperature to rise (1) other factors could cause the rise in temperature (1) OR **First two marking points** as the (mean global) temperature increases (1) concentration/amount} of carbon dioxide increases (1) **Third marking point** dependent on at least 1 comment from a graph any 1 from: human activity could be causing	**Allow** the patterns of increase in carbon dioxide and temperature are different (2)	**(3)**

	the rise in carbon dioxide (1) (world) population has increased (so the amount of carbon dioxide has increased) (1) (increase in) use of {fossil/carbon-based} fuels (produces more carbon dioxide) (1) (increase in) deforestation (decreases the amount of carbon dioxide removed by photosynthesis)		

Question Number	Answer	Acceptable answers	Mark
4(a)	**A** chalk		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	1.10 (g) (1) or 1.1 (g) (1) or 2.50 – 1.40 (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	A suggestion including heat remaining solid/ heat it for longer / heat it again (1) mass after heating stays the same / gas does not turn limewater milky (1) or add acid (1) no effervescence (1)	**Ignore** reference to repeating the whole experiment again / heating a new sample of solid **Allow** add Universal Indicator and it stays red (after adding acid)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	$CaO + H_2O \rightarrow Ca(OH)_2$ LHS formulae correct (1) RHS formula correct (1) maximum 1 mark if any incorrect balancing	**Allow** $Ca(HO)_2$ **Allow** multiples **Reject** obvious incorrect symbols and subscripts once only	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)	initial total mass = 11.00 + 10.50 (1) = 21.50/21.5 (g) total mass remaining = 21.50 – 1.00 (1) = 20.50/20.5 (g) marks are for the working	20.50/20.5 (g) with no working (2) **Allow** 11.00 + 10.50 + 1.00 = 22.5/22.50 (g) (1) 22.5/22.50 (g) with no working (0) **Allow** correct working with incorrect answers	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)	An explanation linking two of {neutralises / reacts with / removes / destroys/ gets rid of / takes in} the (waste) gases(1) acid(ic) (gases) / carbon dioxide / sulfur dioxide / oxides of nitrogen (1)	**Ignore** calcium carbonate is a base/alkali **Allow** stops (the waste gases) being released **Allow** {reduces/prevents} acid rain (1) **Ignore** toxic (gases) **Allow** acidic waste	**(2)**

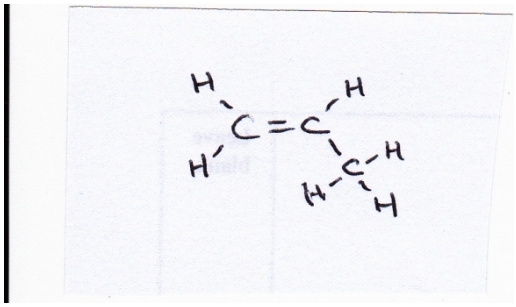
Question Number	Answer	Acceptable answers	Mark
5(a)(i)	carbon (is oxidised)	Just 'carbon dioxide' (0)	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	**Maximum 1 mark if answer only mentions one of the metals.** An explanation linking two of iron is lower in reactivity than aluminium/ORA (1) carbon can remove the oxygen from iron oxide (1) electrolysis is a more powerful method (than using carbon) / electrolysis is needed to {remove the oxygen from/reduce} aluminium oxide (1) iron compounds less stable than aluminium compounds/ORA (1)	**Allow** carbon is more reactive than iron /ORA(1) **Allow** aluminium is more reactive than carbon /ORA (1) **Ignore** carbon can reduce iron oxide **Ignore** electrolysis is used to extract aluminium	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)	An explanation linking three of atoms of gold all the same (size) (1) in pure gold {layers/rows/sheets/lines} of the {gold / metal} atoms slide over each other (when force is applied) (1) copper atoms are {smaller / different size} (1) (copper atoms) {disrupt / distort /disturb} the {structure / layers} (1) stops {layers/rows/sheets/lines} of gold atoms from sliding over each other (1)	**Reject** the use of the word molecule once only **Allow** particles If layers/rows/sheets/lines is omitted twice, you can award one mark.	**(3)**

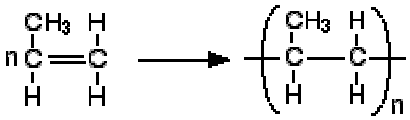
<table>
<tr><th colspan="2">Question Number</th><th>Indicative Content</th><th>Mark</th></tr>
<tr><td>QWC</td><td>*5(c)</td><td>An explanation including some of the following points
<table>
<tr><th>Use</th><th>Relevant properties</th></tr>
<tr><td>Aluminium</td><td></td></tr>
<tr><td>aeroplanes, cars, bicycles, trains, trucks, ladders, window frames, door frames, greenhouses, pylons, ship masts, walking poles, golf clubs, baseball bats</td><td>low density (allow light), strong, resistant to corrosion</td></tr>
<tr><td>(overhead) power/electricity cables</td><td>low density (allow light), good conductor of electricity, resistant to corrosion</td></tr>
<tr><td>foil, food packaging, cans, sweet wrappers, saucepans, blister packs for pills</td><td>low density (allow light), resistant to corrosion</td></tr>
<tr><td>Copper</td><td></td></tr>
<tr><td>electrical wires/cables, lightning conductors, electromagnets</td><td>good conductor of electricity</td></tr>
<tr><td>water pipes, roofing, coins, jewellery, statues, musical instruments</td><td>resistant to corrosion</td></tr>
<tr><td>Gold</td><td></td></tr>
<tr><td>jewellery, coins, in dentistry</td><td>excellent resistance to corrosion, valuable, low strength</td></tr>
<tr><td>electronic devices, circuit boards, switch contacts</td><td>excellent conductor of electricity</td></tr>
<tr><td>Silver</td><td></td></tr>
<tr><td>jewellery, cutlery, coins</td><td>very good resistance to corrosion, valuable, low strength</td></tr>
<tr><td>electronic devices, circuit boards, switch contacts</td><td>excellent conductor of electricity</td></tr>
</table>
General points
A property must be relevant to the use and from the table in the question.
Ignore additional properties.
Look for the use first, then the relevant property. Candidates who just re-write or compare the properties with no uses score no marks.
Ignore non-specific uses such as building materials/structures, making alloys</td><td>(6)</td></tr>
</table>

Level	**0**	No rewardable content
1	**1 - 2**	a limited explanation e.g. states correct uses of two metals / explains a use of one of the metals related to a property in the table the answer communicates ideas using simple language and uses limited scientific terminology spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	a simple explanation e.g. states correct uses of three metals and relates one use to a property / explains uses of two metals related to their properties in the table the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	a detailed explanation e.g. explains uses of three metals and relates use to property in the table in each case the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately spelling, punctuation and grammar are used with few errors

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	 **one** C=C in a three consecutive carbon atom molecule (1) rest of structure correct, ignore bond angles, conditional on first marking point(1)	allow methyl group written as CH_3	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	**B** C_7H_{16}		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	A description including add bromine (water) / aqueous bromine (and shake the tube)(1) stays orange / no change / does not go colourless in {propane/alkane} (1) turns colourless / decolorises in {propene/alkene} (1) Maximum 1 mark for 2 correct observations with an incorrect reagent or no reagent specified	**Allow** recognisable spelling for bromine **Allow** yellow / brown or combinations of these for orange **Ignore** just 'red' **Ignore** clear / discoloured one correct test with statement or clear implication that the other must be the other gas for full marks eg add bromine water to both gases, the one that turns it colourless is propene, scores 3 marks as it is clearly implied that the other gas does not turn it colourless	**(3)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	An explanation including some of the following points **Making the polymer** many propene molecules join/react together form a long chain polymerisation reaction propene is the monomer propene is unsaturated / has a double bond poly(propene) has single bonds propene is a gas and forms poly(propene) which is a solid the C=C bond breaks / opens up  **Properties of poly(propene) with related uses** e.g. property – flexible, low density (lightweight), shatterproof, high softening point, non-toxic, strong, tough, good insulator, water proof, resistant to corrosion, long lasting, can be moulded into shape, can be made into fibres Uses of poly(propene) use – to make plastic bags, packaging, buckets, bowls, food containers, ropes, carpets, thermal underwear, Thinsulate items, toys, bottles, bottle caps, laboratory equipment, medical equipment, pipes, car bumpers, crates, furniture, tubing	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	a limited explanation of how to make the polymer or properties or uses e.g. propene molecules join together to form the polymer / polypropene can be used to make carpets the answer communicates ideas using simple language and uses limited scientific terminology spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	a simple explanation of how to make the polymer and/or properties and/or uses e.g. propene molecules are monomers and join together to make poly(propene)/ poly(propene) is used to make buckets because it can be moulded into shape the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	a detailed explanation including reference to how to make the polymer, its uses and properties e.g. propene molecules have a double bond and poly(propene) can be used to make washing up bowls because it is strong. / propene molecules have a double bond and many of them join together to make polypropene which is used to make ropes. the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately spelling, punctuation and grammar are used with few errors	

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Surname	Other names

Edexcel GCSE

Centre Number	Candidate Number

Chemistry/Science

Unit C1: Chemistry in Our World

Higher Tier

Monday 21 May 2012 – Morning **Time: 1 hour**	Paper Reference **5CH1H/01**

You must have: Calculator, ruler	Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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Questions begin on next page.

Answer ALL questions

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The reactivity series

1 The list shows some metals in reactivity series order with the most reactive at the top.

most reactive	calcium
	magnesium
	aluminium
	zinc
	iron
	copper
least reactive	gold

(a) Which of these metals can be found as the uncombined metal in the Earth's crust?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** calcium

☐ **B** gold

☐ **C** magnesium

☐ **D** zinc

(b) Metals are extracted by the reduction of their ores.

State the meaning of the term **reduction**.

(1)

.....

.....

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(c) Aluminium is extracted by the electrolysis of a molten mixture of its ore (bauxite) and cryolite.
Iron is extracted by heating a mixture of its ore and carbon.

Explain why electrolysis is used to extract aluminium but is not used to extract iron.

(2)

.....

.....

.....

.....

(d) An alloy of aluminium with magnesium is used for parts of aeroplanes.



Explain why the aluminium alloy is stronger than pure aluminium.

(2)

.....

.....

.....

.....

(e) When aluminium corrodes, it reacts with oxygen to form aluminium oxide, Al_2O_3.

Complete the balancing of this equation by putting numbers in the spaces provided.

(2)

..... Al + ... O_2 → $2Al_2O_3$

(Total for Question 1 = 8 marks)

Carbon dioxide levels in the atmosphere

2 Scientists believe that, about 4500 million years ago, the Earth was very much hotter than it is now.
The atmosphere then was very different from that on Earth today.

(a) Explain why it is difficult to be precise about the composition of the Earth's early atmosphere.

(2)

(b) As the Earth cooled, oceans formed.

How did this affect the composition of the atmosphere?

(1)

(c) The first plants appeared about 400 million years ago.

Explain how the growth of these plants affected the composition of the atmosphere.

(2)

(d) What is the current approximate percentage of carbon dioxide in the Earth's atmosphere?

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** 0.04
- ☒ **B** 1.0
- ☒ **C** 4.0
- ☒ **D** 10

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(e) The amount of carbon dioxide in the Earth's atmosphere has been rising over the past fifty years, mainly caused by an increase in the quantity of fossil fuels that have been burned.

State another cause of increasing amounts of carbon dioxide in the atmosphere.

(1)

.....

.....

(Total for Question 2 = 7 marks)

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Hydrocarbons

3 (a) During fractional distillation, crude oil is separated into a number of fractions.

The table shows the relative amount of these fractions that can be obtained from crude oil.

The table also shows the relative demand for each of these fractions.

fraction	relative amount obtained	relative demand
LPG	2	6
petrol	12	29
kerosene	16	11
diesel	24	29
fuel oil and bitumen	46	25

(i) For which fractions does the demand exceed the supply?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** kerosene, diesel, fuel oil and bitumen

☒ **B** LPG, petrol and diesel

☒ **C** LPG, petrol and kerosene

☒ **D** petrol, diesel, fuel oil and bitumen

(ii) In another process, called cracking, large molecules in some fractions are converted into smaller molecules.

Explain why cracking is needed.

(2)

(b) The table shows the number of carbon atoms per molecule in the substances present in each of the fractions.

fraction	number of carbon atoms per molecule
LPG	1 – 4
petrol	4 – 12
kerosene	9 – 16
diesel	15 – 25
fuel oil and bitumen	over 25

Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

As the number of carbon atoms in the molecules of a hydrocarbon increases

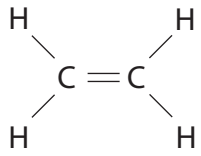
☒ **A** the number of hydrogen atoms in the molecule remains the same

☒ **B** the boiling point of the hydrocarbon increases

☒ **C** the hydrocarbon becomes easier to burn

☒ **D** the viscosity of the hydrocarbon decreases

(c) The structure of a molecule of ethene is



(i) What is the formula of a molecule of ethene?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** CH_2

☒ **B** C_2H_4

☒ **C** C_nH_{2n}

☒ **D** $(CH_2)_n$

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(ii) Ethene can be converted into poly(ethene).

Write a balanced equation for this reaction.

(2)

(d) Many power stations generate electricity by burning fossil fuels, such as fuel oil. This process adds carbon dioxide to the atmosphere.

(i) Explain why some people are concerned about the increase in the amount of carbon dioxide in the atmosphere.

(2)

(ii) Some hydrocarbon fuels can contain sulfur impurities.

Explain how the product of combustion of these sulfur impurities affects the environment.

(2)

(Total for Question 3 = 11 marks)

Calcium compounds

4 Calcium carbonate is an important raw material in the chemical industry.
It exists naturally as chalk, marble and limestone.

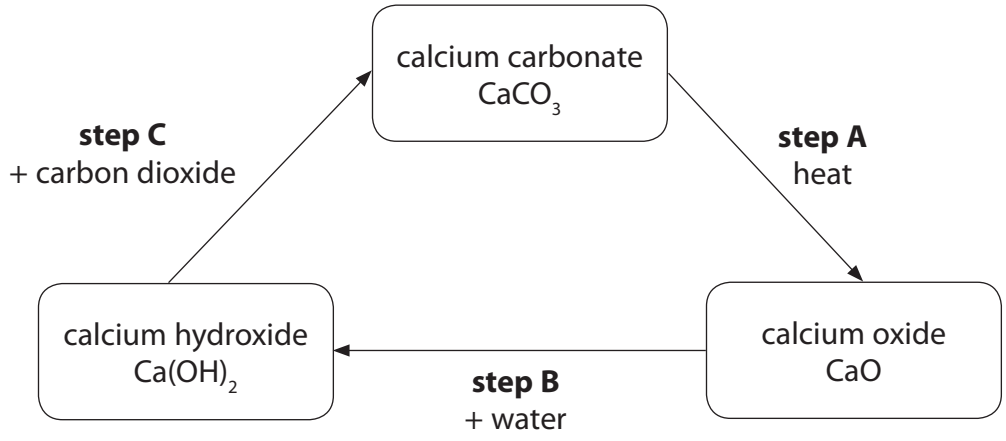
(a) Which row of the table correctly identifies chalk, marble and limestone as sedimentary or metamorphic rocks?

Put a cross (☒) in the box next to your answer.

(1)

		chalk	marble	limestone
☒	**A**	sedimentary	sedimentary	metamorphic
☒	**B**	metamorphic	metamorphic	sedimentary
☒	**C**	sedimentary	metamorphic	sedimentary
☒	**D**	metamorphic	sedimentary	metamorphic

(b) The diagram shows reactions of some calcium compounds.



(i) Both calcium carbonate and calcium oxide are white solids.

Suggest how you could show that, when calcium carbonate is heated, a reaction takes place.

(2)

.....

.....

.....

.....

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(ii) Describe what you would observe when water is added, one drop at a time, to cold calcium oxide (**step B**).

(2)

(iii) Write the balanced equation for the reaction of calcium hydroxide with carbon dioxide (**step C**).

(2)

(iv) State the common name for calcium hydroxide solution.

(1)

(c) Explain why calcium carbonate removes acidic gases from emissions in power station chimneys.

(2)

(Total for Question 4 = 10 marks)

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Electrolysis

5 Electrolysis occurs when solutions of some compounds are decomposed by passing direct electric current through them.

(a) Sodium chloride solution was electrolysed.
The reaction produced chlorine and hydrogen.
The remaining solution contained sodium hydroxide, NaOH.

(i) State a hazard associated with chlorine gas.

(1)

.....

(ii) Describe a test that can be used to identify a sample of gas as chlorine.

(2)

.....

.....

.....

.....

(iii) State a use of chlorine.

(1)

.....

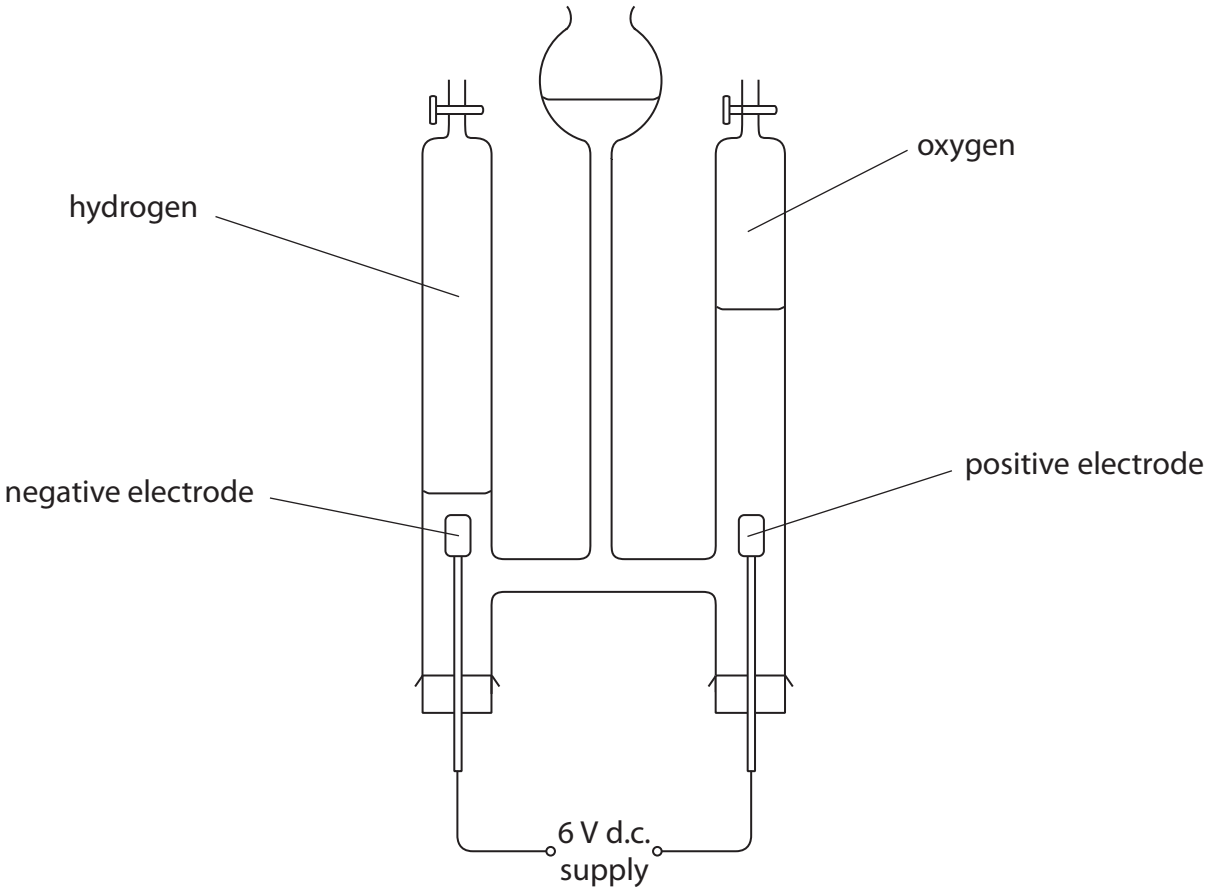
(iv) Complete and balance the equation for the overall reaction taking place when sodium chloride solution is electrolysed.

(2)

..... NaCl + ... H_2O → ..... + ... + ...

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*(b) Water was decomposed by electrolysis in the apparatus shown.



The water decomposed into hydrogen and oxygen.
After five minutes, the volumes of hydrogen and oxygen in the tubes were measured.

Two further experiments were carried out changing only one factor in each experiment. All other factors were kept the same.

The table shows the conditions and results of all three experiments.

experiment	time / minutes	current / amps	volume of hydrogen / cm^3	volume of oxygen / cm^3
1	5	0.50	20.0	10.0
2	10	0.50	40.0	20.0
3	5	0.75	30.0	15.0

Use these results of electrolysis to compare the volumes of hydrogen and oxygen formed and to show the effect of changing the time and the current on the volumes of these gases.

(6)

(Total for Question 5 = 12 marks)

Alternative fuels

6 Known crude oil deposits are being used up.
In the past, most of our fuels, such as petrol, have been obtained from crude oil.

(a) Fuels such as those obtained from crude oil are non-renewable. Efforts are being made to replace these types of fuels with renewable fuels.

Explain the difference between **non-renewable** and **renewable** fuels.

(2)

*(b) Evaluate the advantages and disadvantages of using bioethanol, instead of petrol, as a fuel for cars.

(6)

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(c) The photograph shows one of the new buses for London.



The bus uses hydrogen as a fuel.
There are six hydrogen fuel tanks, which can be seen on the roof of the bus.
The hydrogen from the tanks reacts with oxygen from the air in a fuel cell to release energy to power the bus.

(i) Write the balanced equation for the overall reaction that takes place when the hydrogen reacts with oxygen in the fuel cell.

(3)

.....

(ii) Like all fuels, hydrogen, when mixed with air and ignited, explodes.

Apart from the possibility of an explosion, state another disadvantage of using hydrogen, rather than diesel, as a fuel for buses.

(1)

.....

.....

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2012

GCSE Chemistry
5CH1H/01

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GCSE Chemistry 5CH1H/01 Mark Scheme – Summer 2012

Question Number	Answer	Acceptable answers	Mark
1(a)	**B** gold		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	{loss of / remove} oxygen	gain of electrons	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)	An explanation linking **either** • aluminium high(er) in reactivity / aluminium more reactive than carbon / aluminium compounds are very stable (1) **or** • iron lower in reactivity / iron less reactive than carbon / iron compounds less stable (1) **plus** one of • (for aluminium) electrolysis is powerful means of reduction / needs powerful means of extraction / needs more energy (1) • (for iron) can be reduced with {carbon / carbon monoxide} / use of carbon is cheaper / use of electricity is expensive / ORA (1)	stronger means of reduction can be reacted with {carbon / carbon monoxide} **and** oxygen removed	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(d)	An explanation linking the following points • (magnesium and aluminium) {atoms / ions / particles} are different sizes (1) • this prevents the layers (of atoms / ions / particles) sliding over each other (1)	magnesium atoms are larger than aluminium atoms **OR** aluminium atoms are larger than magnesium atoms sheets / rows penalise molecules only once	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(e)	4 (Al) + 3 (O_2) → ($2Al_2O_3$) 4 (1) 3 (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)	An explanation linking **two** of the following points • nobody was there / OWTTE (1) • there are no (written) records / measurements (1) • {different / conflicting} sources of information (1)	 {limited / unreliable} evidence e.g. data based on atmospheres on other planets (gases in) ice core and rock data not old enough	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	lowered the amount of {water vapour / carbon dioxide} / oceans absorbed carbon dioxide	**reject** all removed	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)	An explanation linking **two** of the following points • photosynthesis (in plants) (1) • {decreased / absorbed} carbon dioxide (1) • {increased / released} oxygen (1)	 if respiration confused with photosynthesis max 1	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(d)	**A** 0.04		**(1)**

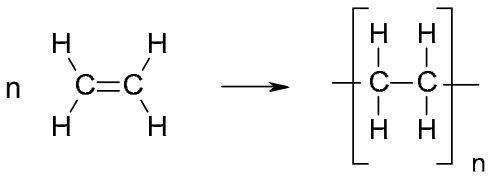
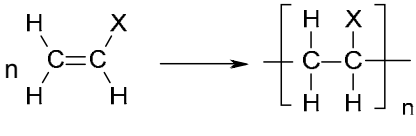
Question Number	Answer	Acceptable answers	Mark
2(e)	Any **one** from the following points • deforestation (1) • volcanic activity (1) • respiration (1) • increase in temperature (1)	 more animals **ignore** references to biofuels	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	**B** LPG, petrol and diesel		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	An explanation linking **two** of the following points • use of {fractions / large molecules / long chain hydrocarbons} of {less demand / less useful / lower value} / ORA (1) • to meet demand / small molecules needed (1)	**reject** useless use up excess kerosene / fuel oil and bitumen to make more petrol / LPG / alkenes	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)	**B** the boiling point of the hydrocarbon increases		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	**B** C_2H_4		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	 (2) ignore n missing on polymer structure LHS (1) RHS (1) Allow:  (1) (where X could be CH_3 or similar)	n C_2H_4 → $(C_2H_4)_n$ (2) Note: Displayed formulae alkene with **C=C** polymer – single bonds between atoms with continuation bonds Allow any number of C_2H_4 on LHS **drawn out** with corresponding structure of polymer on RHS	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)(i)	An explanation linking the following points • greenhouse gas / traps heat in atmosphere (1) • may lead to increasing global temperature / global warming (1)	traps infra-red radiation / **increases** greenhouse effect **reject** reference to UV melting {ice caps / glaciers} / climate change / sea-level rising / loss of habitats **reject** reference to ozone layer	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)(ii)	An explanation linking **two** of the following points • sulfur dioxide formed (during combustion of fuel) (1) • sulfur dioxide {dissolves in rain / forms acid (rain)} (1) • an effect of acid rain e.g. harms {fish / plants / statues / buildings} / lowers pH of lakes (1)	SO_2 possible harm to human respiration	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)	**C** sedimentary / metamorphic / sedimentary		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	A description linking **one** of the following pairs **Either** • {find mass of / weigh} solid before heating (1) • (heat in a suitable container) and {find mass / weigh} again (when cool) (1) **Or** • {bubble / pass} the gas produced through limewater(1) • limewater turns {cloudy / milky} (1)	Any other description that proves a change is taking place (Measure) change in mass 1 mark only **Ignore** carbon dioxide puts out lighted splint	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	A description including **two** of the following points • fizzing / hissing (1) • steam (1) • swells (1) • solid crumbles (to a powder) (1) • becomes hot (1)	**Ignore** bubbling / solution **Ignore** boiling list principle applies	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$ left hand side (1) right hand side (1)	allow multiples incorrect balancing scores 1 max	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iv)	limewater	lime water	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)	An explanation linking **two** of the following points • (calcium carbonate) reacts with {acidic gases / sulphur dioxide} (1) • (because) calcium carbonate is a base (1) • to form a salt / calcium sulfate (1) • neutralisation (reaction) (1)	**Ignore** calcium carbonate is an alkali neutralises acidic gases = 2 marks two marks can be scored with suitable balanced equation : e.g. $CaCO_3 + SO_2 + ½ O_2 \rightarrow CaSO_4 + CO_2$	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	toxic / poisonous (gas)	Ignore other words such as harmful / dangerous / smelly / corrosive	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	A description including the following points • (damp blue) litmus (paper) (1) • (turns red then) white / bleaches (1)	Allow use of any suitable named indicator with correct result eg • (damp) universal indicator paper (1) • (turns red then) white (1) OR • (damp) starch iodide paper (1) • (turns) dark blue / black (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	making {poly(chloroethene / PVC / solvents / medicines / agrochemicals / disinfectants} bleach / sterilising water / killing bacteria	**ignore** water purification / "swimming pools" micro-organisms	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iv)	$2NaCl + 2H_2O \rightarrow 2NaOH + H_2 + Cl_2$ correct products (1) balancing of correct formulae (1)	$NaCl + H_2O \rightarrow NaOH + ½ H_2 + ½ Cl_2$	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(b)**	A comparison including some of the following points **Comparing volumes of hydrogen and oxygen** • (in each experiment) volume of hydrogen is twice volume of oxygen • because water molecules contain twice as many hydrogen atoms as oxygen atoms / is H_2O • overall $2H_2O \rightarrow 2H_2 + O_2$ **Relating volumes of gases to current and time** • (from experiments 1 and 2) time doubles • (from experiments 1 and 2) volumes of gases double • Volumes of gases are directly proportional to the time for electrolysis / passage of current • (from experiments 1 and 3) as current x 1.5 • (from experiments 1 and 3) volumes of gases x 1.5 • volumes of gases are directly proportional to the current	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of one trend e.g. increased time gives an increased gas volume • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. if the time is doubled, the volume of gas is doubled and if the current is increased the volume of gas increases • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. volume of hydrogen is twice volume of oxygen and as time doubles, volume of gas doubles or as current x 1.5, volume of gas x 1.5 • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)	A description linking **one** from each of the following pairs: Non-renewable • e.g. fossil fuels (1) • when used, not replaced (in a reasonable time) / finite supply (1) Renewable fuels • produced {from plants / electrolysis (to produce hydrogen)} (1) • (therefore) when used, able to be (quickly) replaced (1)	**ignore** can't be used again **ignore** won't run out / infinite supply / can be used again	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(b)**	**An evaluation including some of the following points** **Advantages of bioethanol** • is renewable / petrol is finite / takes a long time to form crude oil • crops to make bioethanol regrown quickly/takes a long time to form crude oil • use reduces demand on fossil fuels • carbon dioxide is removed from air when growing crops (which are used in ethanol production) • may be sulfur impurities in petrol, none in ethanol / ethanol is less polluting than petrol (does not produce sulphur dioxide) • ethanol burns more completely, petrol does not **Disadvantages of bioethanol** • less readily available than petrol / fewer filling stations than for petrol (in UK but not in some countries) • lots of crops needed to generate sufficient fuel to replace petrol • less farmland available for growing food crops • currently few cars are built to run on bioethanolbioethanol fuel (in cars) runs out faster / over shorter distances / less energy efficient	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. using ethanol conserves oil deposits • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. growing plants gives continuous supply of bioethanol but petrol comes from crude oil which is finite • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. growing plants remove carbon dioxide from the air but lots of crops are needed to make sufficient bioethanol to replace petrol therefore less land to grow food crops • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(c)(i)	$2\ H_2 + O_2 \rightarrow 2\ H_2O$ (3) or left hand side – $H_2 + O_2$ (1) right hand side - H_2O (1) balancing - 2 (H_2) ... 2 (H_2O) (1)	$H_2 + ½\ O_2 \rightarrow H_2O$ (3)	**(3)**

Question Number	Answer	Acceptable answers	Mark
6(c)(ii)	Any **one** from the following points • requires {electricity / energy} for electrolysis (1) • must be stored in {heavy / strong / pressurised} cylinders (1) • gas can escape easily (1) • fewer fuel stations (1)		**(1)**

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Centre Number	Candidate Number

Chemistry/Science

Unit 1: Chemistry in Our World

Higher Tier

Thursday 1 March 2012 – Morning **Time: 1 hour**	Paper Reference **5CH1H/01**

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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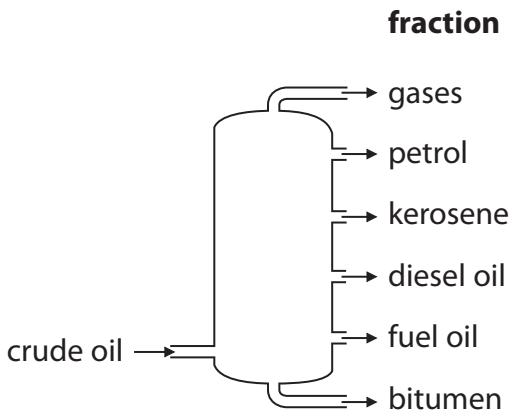
TURN OVER FOR QUESTION 1

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Useful products from crude oil

1 Fractional distillation is used to separate crude oil into fractions.
A fractionating column is used for the process.
The diagram shows a fractionating column and the fractions obtained when crude oil is fractionally distilled.



(a) Which of the following statements is true?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** fuel oil has a lower boiling point than petrol

☒ **B** kerosene is more viscous than bitumen

☒ **C** molecules in diesel oil are larger than molecules in petrol

☒ **D** diesel oil is easier to ignite than petrol

(b) Some fractions obtained from crude oil are cracked to produce alkenes.

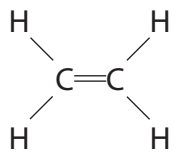
(i) Explain what is meant by **cracking**.

(2)

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(ii) One alkene obtained is ethene.
The diagram shows the structure of a molecule of ethene.



Ethene is unsaturated.
Ethene is a hydrocarbon.

Explain why ethene is described as an **unsaturated hydrocarbon**.

(3)

(iii) Describe what you would **see** when a sample of ethene is shaken with bromine water.

(2)

(Total for Question 1 = 8 marks)

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Gases in the atmosphere

2 (a) The table shows possible percentages of some of the gases in the Earth's early atmosphere.

gas	percentage in early atmosphere (%)
oxygen	small amount
nitrogen	small amount
carbon dioxide	12
water vapour	77

(i) Some time after the early atmosphere had been formed, oceans appeared on the Earth's surface.

State how these oceans were formed.

(1)

.....

.....

(ii) The amount of carbon dioxide in today's atmosphere is much lower than that in the early atmosphere.

State how the formation of the oceans caused this reduction.

(1)

.....

.....

(iii) The amount of oxygen in today's atmosphere is much higher than that in the early atmosphere.

Describe the process that has caused this increase.

(2)

.....

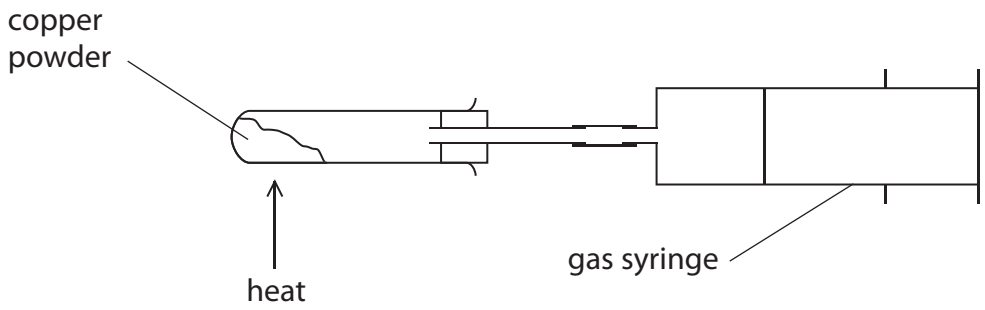
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(b) John was doing an experiment to find the percentage of oxygen in air at room temperature.
He used this apparatus.



The copper powder in the test tube was heated strongly so that it could react with oxygen in the air in the apparatus.
John stopped heating the copper when there was no further change in the reading on the gas syringe.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

At the end of the experiment the apparatus was allowed to cool before the final reading on the syringe was recorded.

This is because

(1)

☒ **A** reading the volume while the apparatus is hot is dangerous

☒ **B** the apparatus must be left to allow the reaction to finish

☒ **C** the gas must be at room temperature when its volume is measured

☒ **D** the copper expands when it is hot

(ii) At the end of the experiment not all of the copper had reacted.

Suggest a reason for this.

(1)

.....

.....

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(iii) John's results were
initial volume of gas in syringe = 32 cm^3
final volume of gas in syringe = 24 cm^3

Calculate the percentage decrease in the volume of gas originally in the syringe.

(2)

.....

.....

.....

percentage decrease = ...

(iv) The percentage of oxygen in air at room temperature is 21%.
John thought the answer to part (iii) was the percentage of oxygen in air and was surprised that the value was too high.

John confirmed that he had not made an error when doing his experiment.
Suggest why the answer calculated in part (iii) is higher than John expected.

(1)

.....

.....

.....

(Total for Question 2 = 9 marks)

Metals

3 Metals have many uses.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

Aluminium and magnesium are melted together to form magnalium.

Magnalium is

(1)

☒ **A** an element

☒ **B** an ore

☒ **C** an alloy

☒ **D** a type of steel

(b) Describe how iron is extracted from its ore.

(2)

(c) Copper oxide reacts with hydrogen to form copper and water.

The equation for the reaction is

$$CuO + H_2 \rightarrow Cu + H_2O$$

Explain how this reaction involves both oxidation and reduction.

(3)

P 4 0 1 9 8 A 0 1 0 2 0

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(d) Some modern spectacle frames are made of shape memory alloys.



Explain why shape memory alloys are better than other alloys for making spectacle frames.

(2)

.....

.....

.....

.....

(e) Complete the sentence by putting a cross (☒) in the box next to your answer.

Alloys are usually stronger than the pure metals from which they are made because they

(1)

☒ **A** have stronger bonds between the molecules they contain

☒ **B** combine the properties of the metals from which they are made

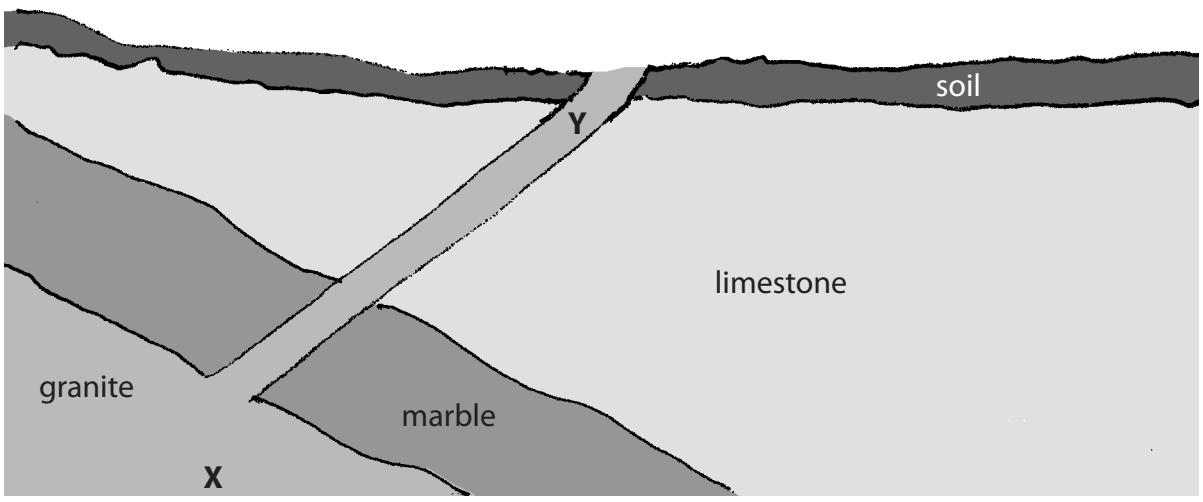
☒ **C** have atoms of different sizes in their structures

☒ **D** are made using electrolysis

(Total for Question 3 = 9 marks)

Rocks

4 A student produced this sketch of a quarry face.



(a) The limestone shown was originally formed in layers.

State what type of rock limestone is.

(1)

(b) Granite is an igneous rock formed from magma.

(i) Explain how the marble has formed above the granite.

(2)

(ii) Explain why the rock at **X** contained larger crystals than the rock at **Y**.

(2)

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(c) Limestone is a natural form of calcium carbonate.
When calcium carbonate, $CaCO_3$, is heated it decomposes.

(i) Complete the equation for this reaction.

(1)

$$CaCO_3 \rightarrow CaO + \text{.....}$$

(ii) Calcium oxide reacts with water to form calcium hydroxide.

Write the balanced equation for this reaction.

(2)

.....

(iii) Explain why calcium hydroxide (slaked lime) is spread on fields.

(2)

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.....

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(Total for Question 4 = 10 marks)

Chemical reactions

5 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

When dilute hydrochloric acid reacts with copper oxide one of the products is

(1)

☒ **A** copper

☒ **B** copper hydroxide

☒ **C** copper chlorate

☒ **D** copper chloride

(b) Chlorine is manufactured by electrolysis.

Explain what is meant by **electrolysis**.

(2)

(c) Chlorine gas reacts with sodium hydroxide solution to form sodium chlorate(I), NaOCl, sodium chloride and water.

Write the balanced equation for this reaction.

(3)

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*(d) Sulfur is an impurity in some fossil fuels.

Explain how the presence of sulfur in fossil fuels can lead to damage to the environment and how the amount of damage can be reduced.

(6)

(Total for Question 5 = 12 marks)

Burning fuels

6 The picture shows a gas water heater.
The fuel used in this heater is natural gas which is mainly methane.



(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

Natural gas is a good fuel because

(1)

☒ **A** supplies of it will never run out

☒ **B** it always burns with a yellow flame that is easily seen

☒ **C** it produces no waste gases on complete combustion

☒ **D** it produces no solid waste on complete combustion

(b) The complete combustion of fossil fuels releases gases into the atmosphere.

Explain how these gases could cause an increase in the temperature of the Earth.

(2)

.....

.....

.....

.....

(c) Biofuels, made from plants, can be used as alternatives to fossil fuels.

(i) State an advantage of replacing fossil fuels with biofuels made from plants.

(1)

.....

.....

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(ii) Explain a disadvantage of replacing fossil fuels with biofuels made from plants.

(2)

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*(d) Incomplete combustion of methane can occur in gas heaters such as the one shown in the photograph.

Explain how incomplete combustion occurs and the problems it can cause.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

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GCSE Chemistry
5CH1H/01

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March 2012

Question Number	Answer	Acceptable answers	Mark
1(a)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	An explanation linking **two** of the following points • break down of (hydrocarbons/molecules / alkanes) (1) • into smaller (hydrocarbons/molecules / alkanes) (1)	**Ignore** 'chains **of** …..'/ polymers Ignore 'separating Ignore reasons for cracking	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b) (ii)	an explanation linking the following • (molecule) containing (carbon-carbon) double / multiple bond (1) • contains (atoms of) carbon and hydrogen (1) • only (1)	Allow references to addition reactions. Ignore 'alkene', 'spare bonds', 'doesn't have max no of atoms or H bonded' Can only score third point if second point scored	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	a description including the following • from orange/brown/yellow (1) • to colourless (1)	Allow red-brown but no other mention of red **Ignore** clear / discolour	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	{water vapour / steam} condensed/ changed to liquid	Allow steam cooled	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	(carbon dioxide) dissolved/ absorbed / trapped	Ignore refs to plants/ rocks	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	A description including the following points • (primitive) plants (produce oxygen) (1) • (by) photosynthesis (1)	Allow named plants Reject answers involving respiration	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	all oxygen {reacted / used up} / excess copper (present)	no oxygen left / insufficient oxygen Reject not enough time / not hot enough	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iii)	volume gas used = 32-24 (1) = 8 (cm^3) percentage = 32-24/32 x 100 (1) = 25 (%)		**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iv)	oxygen in air in test tube also reacted /more than 32 cm^3 of air because of air in test tube / air in test tube will react but is not measured	some gases leaked out of apparatus allow another gas has reacted with copper	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	a description including the following • heat/reduced {with} (1) • (with) carbon/coke/carbon monoxide(1)	**Ignore** references to blast furnace **Reject** references to electrolysis	**(2)**

Question Number	Answer	Acceptable answers	Mark
3 (c)	A description including **three** of the following, with a maximum of **two** from either group of three • reduction is the loss of oxygen (1) • copper(oxide) loses oxygen (1) • (hence) copper (oxide) is reduced (1) OR • oxidation is the gain of oxygen (1) • hydrogen gains oxygen (1) • (hence) hydrogen is oxidised (1)		**(3)**

Question Number	Answer	Acceptable answers	Mark
3(d)	an explanation linking **one** of the following pairs • when bent / deformed (1) • shape memory alloys return to their original shape (1) OR • shape memory alloys return to their original shape (1) • (but) other alloys stay deformed (1)	must refer to metal's shape being changed i.e. ignore "broke", "sat on etc."	**(2)**

Question Number	Answer	Acceptable answers	Mark
3 (e)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
4 (a)	sedimentary		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	An explanation linking **two** of the following • limestone (1) • (changed by) heat (1) • (changed by) pressure (1) • (heat from) magma / {hot / molten} rock (next to it) (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	An explanation linking the following • X cools slowly (1) • Y cools quickly (1) • suggested reason for slower cooling e.g. larger volume (of rock) / further below surface / heat escapes more slowly /further from edge of molten rock (1)	X has cooled slower (than Y) (2) Ignore references to intrusive and extrusive rocks	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	CO_2	**Ignore** carbon dioxide, state symbols **Reject** any other form of formula such as CO2 / CO^2 / Co_2	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	$CaO + H_2O \rightarrow Ca(H0)_2$ • reactant formulae • product formula	Allow $Ca(H0)_2$ max 1 if any incorrect attempt to balance	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(iii)	an explanation linking **two** of the following • (calcium hydroxide) alkaline / base / alkali (1) • **neutralises / neutralisation** (1) • (applied to) acid(ic) (soil) (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	an explanation linking the following • decomposition /break down of {compound / substance / electrolyte}(1) • using electricity / electrical energy / d.c supply (1)	do not allow first point if mention of covalent molecule, substance etc. note examples in spec are water and Hydrochloric acid	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(c)	Cl_2 + 2NaOH → NaOCl + NaCl + H_2O • reactant formulae (1) • product formulae (1) • balancing correct formulae (1)	allow multiples	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(d)**	an explanation linking some of the following: **cause of acid rain** • burning sulfur • produces sulfur dioxide • escapes into atmosphere • dissolves in rain water • forming acidic solution / sulfurous / sulfuric acid • falls to the ground as acid rain **effect of acid rain** • acidification of lakes • kills fish • kills trees / forests • damage / erosion of stonework **reduction of damage** • calcium carbonate • from limestone • may be converted into calcium hydroxide • waste gases from power stations • passed through carbonate or hydroxide • removing sulfur dioxide some of the above points could be made using word or symbol equations	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation e.g. when fuels burn the sulfur makes sulfur dioxide that causes acid rain • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanantion e.g. when the fuel burns, sulfur impurities make sulfur dioxide which gives acid rain. Acid rain reacts with limestone statues. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation e.g. when fuels burn, any sulfur impurities burn to make sulfur dioxide which dissolves in rain to make it more acidic. This rain corrodes metals and limestone. The problem can be solved by removing sulfur from the fuels • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6 (a)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	An explanation linking the following • carbon dioxide / water vapour (released into the atmosphere) (1) • absorbs OWTTE heat (radiated from Earth)(1)	Ignore reference to greenhouse gases or global warming Mention of ozone layer forbids award of second point	**(2)**

Question Number	Answer	Acceptable answers	Mark
6 (c)(i)	(biofuels) renewable / plants remove carbon dioxide from atmosphere / conserves fossil fuels	(almost) carbon neutral ignore biofuels don't run out the word sustainable must be explained to score	**(1)**

Question Number	Answer	Acceptable answers	Mark
6 (c)(ii)	an explanation linking the following • (growing crops for biofuels) requires land (1) • less land for food production / less food / deforestation / destroys habitat / food prices increase (1)	ignore cost of biofuels v fossil fuels note biofuels are crops so food crops must be specified	**(2)**

Question Number		Indicative content	Mark
QWC	*6(d)	an explanation linking some of the following: **Production** • lack of / insufficient oxygen • {blocked burner jets / poor servicing} leads to lack of oxygen • poor ventilation leads to lack of oxygen • complete combustion cannot take place **Product** • produces carbon / soot • produces carbon monoxide **Effects** • wastes fuel • soot stains / damages decorations etc • soot causes health problems • soot may block gas jets • carbon monoxide is toxic • combines with haemoglobin / forms carboxyhaemoglobin • prevents blood carrying oxygen • no oxygen reaches cells / no respiration / death	**(6)**
Level	**0**	No rewardable content	
1	**1-2**	• a limited explanation e.g. in limited air carbon monoxide forms • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, puncuation and grammar are used with limited accuracy	
2	**3-4**	• a simple explanation e.g. 'incomplete combustion of methane is caused by lack of oxygen and forms carbon monoxide which is a toxic gas' • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation e.g. 'if a room is poorly ventilated, the heater will have a limited supply of air causing incomplete combustion. Carbon monoxide gas is formed. Carbon monoxide combines with haemoglobin and is therefore toxic' • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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Edexcel GCSE

Centre Number	Candidate Number

Chemistry/Science

Unit C1: Chemistry in Our World

Higher Tier

Wednesday 9 November 2011 – Morning **Time: 1 hour**	Paper Reference **5CH1H/01**

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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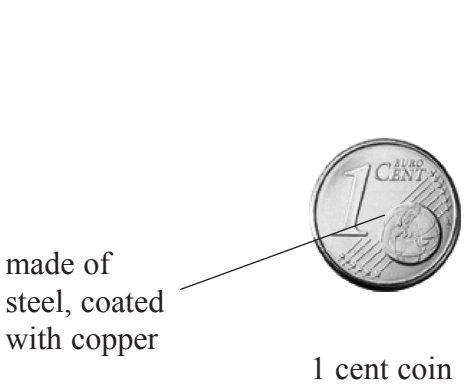
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Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Coins

1 Modern European coins contain mixtures of metals.
The 1 cent and 1 euro coins are shown.



1 cent coin



1 euro coin

(a) (i) Suggest why the 1 cent coin is coated with copper.

(1)

.....

(ii) The 1 euro coin has a silver-coloured centre and a gold-coloured rim.

Compare the compositions of the two parts of the coin to suggest which metal causes the alloy to become gold-coloured.

(1)

.....

.....

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(b) The diagrams show the structure of a pure metal and an alloy it forms with another metal.



pure metal

alloy

Use these diagrams to help you explain why alloying increases the strength of the pure metal.

(3)

(c) Aluminium and iron are both extracted from their oxides.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

Iron is extracted from its oxide by heating the oxide with carbon.
In this process the iron oxide is

(1)

☒ **A** thermally decomposed

☒ **B** oxidised

☒ **C** neutralised

☒ **D** reduced

(ii) Aluminium cannot be extracted from its oxide by heating the oxide with carbon. Electrolysis must be used.

Explain why electrolysis must be used to extract aluminium from its oxide.

(2)

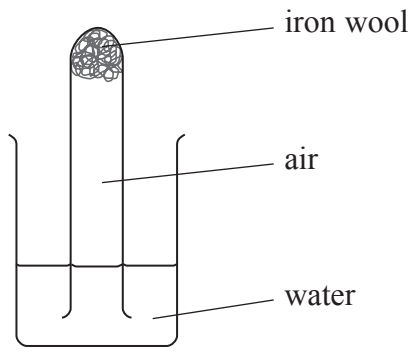
(Total for Question 1 = 8 marks)

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The atmosphere

2 (a) Iron reacts with oxygen to form iron oxide.
Iron wool was placed in the bottom of a wet test tube.

The test tube was then put in a beaker of water as shown in the diagram.



After some time the water level in the test tube rose and some of the iron wool had formed iron oxide.

(i) Write the word equation for the reaction of iron with oxygen.

(1)

(ii) Explain why the water level in the test tube rose during the experiment.

(2)

(iii) The volume of air in the test tube at the start of the reaction was 10 cm^3.

Calculate the volume of gas that should be present in the test tube at the end of the reaction.

(2)

answer = ...

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(iv) Complete the sentence by putting a cross (☒) in the box next to your answer.

Most of the gas remaining in the test tube at the end of the experiment would be

(1)

☒ **A** argon

☒ **B** carbon dioxide

☒ **C** nitrogen

☒ **D** oxygen

(b) Several processes change the composition of the Earth's atmosphere.

Explain how the use of fossil fuels affects the composition of the atmosphere.

(2)

.....

.....

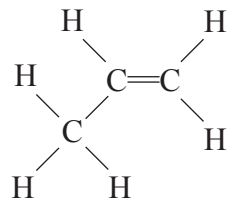
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(Total for Question 2 = 8 marks)

Propene

3 The diagram shows the structure of a propene molecule.



(a) Which row of the table describes propene?

Put a cross (☒) in the box next to your answer.

(1)

	hydrocarbon	unsaturated
☒ **A**	yes	no
☒ **B**	no	yes
☒ **C**	yes	yes
☒ **D**	no	no

(b) Propene can form the polymer poly(propene).

Draw a diagram to show the part of a poly(propene) molecule formed from two propene molecules.

(2)

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(c) Describe a test that shows that molecules of propene contain carbon to carbon double bonds.

(2)

(d) Propene can be made by cracking fractions obtained from crude oil.

(i) This equation shows the cracking of decane to produce propene and butane.

$$\underset{\text{decane}}{C_{10}H_{22}} \rightarrow \underset{\text{propene}}{2C_3H_6} + \underset{\text{butane}}{C_4H_{10}}$$

Give the total mass of products formed if 17 g of decane is cracked in this way.

(1)

(ii) Explain what is meant by **cracking**.

(2)

(iii) Explain why it is necessary to crack crude oil fractions that contain large molecules.

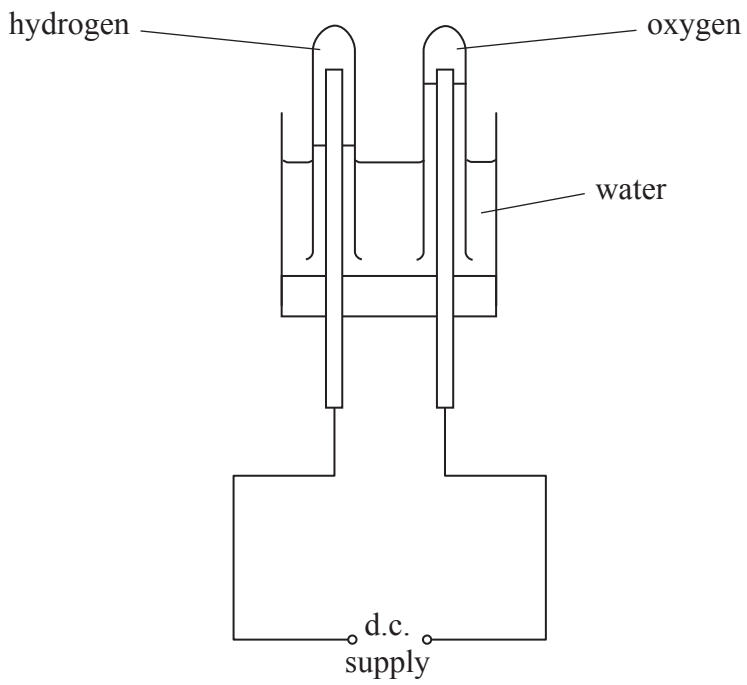
(2)

(Total for Question 3 = 10 marks)

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Useful liquids

4 (a) Water can be decomposed by electrolysis.
Hydrogen and oxygen are formed.
This apparatus can be used to carry out the electrolysis.



(i) Write the balanced equation for water decomposing to form hydrogen and oxygen.

(3)

(ii) Describe the test to show that a gas is hydrogen.

(2)

(iii) Describe the test to show that a gas is oxygen.

(2)

P 4 0 1 7 7 A 0 1 0 1 6

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(b) Seawater can also be decomposed using electrolysis.
Seawater is sodium chloride solution.
When this is decomposed one product is a toxic gas.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The toxic gas produced is

(1)

☒ **A** hydrogen

☒ **B** chlorine

☒ **C** oxygen

☒ **D** carbon monoxide

(ii) Give a safety precaution that should be taken when collecting this toxic gas.

(1)

.....

.....

(c) Sodium chloride solution can be prepared by reacting sodium hydroxide solution with an acid.

Give the name of the acid that must be used.

(1)

.....

(Total for Question 4 = 10 marks)

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Limestone

5 The photograph shows a limestone cliff face.



(a) What is formed from limestone when it is subjected to heat and pressure?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** chalk

☒ **B** granite

☒ **C** marble

☒ **D** fossils

(b) Large quantities of limestone are extracted from quarries.

Give an advantage and a disadvantage, to local communities, of a nearby limestone quarry.

(2)

advantage .....

.....

disadvantage .....

.....

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(c) Limestone is a natural form of calcium carbonate.
Limewater is calcium hydroxide solution.

Describe how limewater can be made from calcium carbonate.

(3)

*(d) Limestone is a sedimentary rock.

The limestone shown in the photograph was originally formed beneath the sea and then earth movements forced the rock upwards to form the cliff.

Describe how the limestone was originally formed and has become the cliff face shown in the photograph.

(6)

(Total for Question 5 = 12 marks)

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Fuels

6 The photograph shows a multifuel camping stove designed to use various fuels.

This stove can burn the hydrocarbon fuels, propane gas, petrol, kerosene or diesel.



(a) Suggest **two** reasons why it is usually difficult to burn different hydrocarbon fuels efficiently in the same appliance.

(2)

reason 1 .....

.....

reason 2 .....

.....

(b) The fuels that can be used in the stove are obtained by the fractional distillation of crude oil.

Which of these statements about the fractions obtained by the fractional distillation of crude oil is correct?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** each fraction is a pure substance

☒ **B** fuel oil is used as fuel for cars

☒ **C** diesel oil is used as a fuel for some trains

☒ **D** some fractions are biofuels

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(c) Ethane, C_2H_6, is present in crude oil.

Write the balanced equation for the complete combustion of ethane.

(3)

*(d) Petrol is the fuel used in many car engines.
Research is being carried out into the use of hydrogen instead of petrol.

Evaluate the advantages and disadvantages of using hydrogen rather than petrol as a fuel for cars.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

November 2011

GCSE Chemistry
5CH1H/01

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5CH1H/01 Mark Scheme
November 2011

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	Any **one** from • steel {corrodes/rusts} • prevents {corrosion/rusting} • (copper) does not {corrode/rust} • (copper) oxidises slower • kills bacteria (1)	copper is less reactive than {iron/steel} does not oxidise/does not react with {oxygen/water} prevents germs spreading cheaper than (using) pure copper **Ignore** to make it less reactive and references to appearance and erosion	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	zinc	Zn	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	An explanation linking **three** of the following: • in pure metal {**layers/sheets**} (of particles){slide/slip/move} (over one another easily) (1) • second (metal) particles larger (1) • disrupt {layers/structure} (1) • prevent {layers/particles} slipping (1)	**Accept** ions or atoms for particles but **reject** molecules different sized particles {lock/hold} layers together Ignore glue	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	An explanation linking **two** of the following • (aluminium) more reactive (1) • forms more stable compounds (1) • more difficult {to remove oxygen /split (compound)} (1) • electrolysis is more powerful method of reduction (1)	too reactive/{above carbon/higher up} in reactivity series forms compounds with stronger bonds carbon {cannot remove oxygen/displace aluminium}	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	iron + oxygen → iron oxide (1) oxygen +iron → iron oxide (1)	= instead of → $4Fe + 3O_2 \rightarrow 2Fe_2O_3$ (symbol equation must be fully correct)	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	An explanation linking **two** of the following • the iron {reacts/combines} with the oxygen (in the air) /iron oxide formed(1) • oxygen removed (from air) (1) • volume of gas decreases / water rises to fill space (1)	**Ignore** absorbs/takes in **Accept** oxygen used up {volume/amount} of air decreases	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	% oxygen in air = 21 / % air remaining = 79 (1) volume of air remaining = $\frac{10 \times 79}{100}$ (1) = 7.9 (cm^3)	% oxygen in air = 20 / % air remaining = 80 **Allow** 2 marks for 7.9 to 8 on its own **Allow** ecf from incorrect % oxygen if clear	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iv)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	An explanation linking **two** of the following • burning/combustion (1) • removes oxygen (1) • adds carbon dioxide (1) • adds water vapour (1)	**Allow** 1 mark for adds sulphur dioxide if clear from sulphur impurities	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	• correct repeating unit(1) • two correct units shown with continuation bonds (1)	any answer with double bonds = 0 **Allow** if correct and more than two units shown	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	A description including **two** of the following points • bromine (water) (1) • (bromine water) turns (from orange) to colourless/or is decolourised (1)	**Ignore** clear/discoloured	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)(i)	17 (g)	seventeen (g)	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(d)(ii)	An explanation linking **two** of the following • break down of hydrocarbons / large molecules / alkanes (1) • into small(er) molecules (1) • into alkanes and alkenes (1)	**Reject** 'chains of molecules' /polymers **Ignore** chains	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)(iii)	An explanation linking **two** of the following: • less demand for (fractions containing) large molecules ORA (1) • large molecules are less useful ORA (1) • specific use of product fractions e.g. petrol / fuel for cars(1) • to make alkenes (1) • specific use of alkenes produced e.g. as monomers / to make polymers / to make plastics (1)	**Reject** are useless named alkenes	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	$2H_2O \rightarrow 2H_2 + O_2$ • reactant formula (1) • product formulae (1) • balancing correct formulae (1)	**Allow** 1 mark for $2H^2O \rightarrow 2H^2 + O^2$ **Ignore** state symbols **Ignore** word equations	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	A description including the following: • lighted splint / ignite gas / gas burns(1) • with (squeaky) pop (if air present) (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	A description including the following • glowing splint (1) • relights (1)	smouldering splint **Ignore** blown out splint lighted splint burns brighter = 2	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	use a fume cupboard/open all the windows /(good) ventilation/wear a **gas** mask	**Ignore** do not breathe in	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)	hydrochloric (acid)	**Ignore** HCl	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	**advantage** (brings in) money / employment (1) **disadvantage** dust / noise pollution /extra traffic /destroys (wildlife) habitat /damages landscape /damages natural beauty / less tourists (1)	provides (local) building material **Ignore** pollution	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(c)	A description linking **three** of the following • heat/thermally decompose (calcium carbonate)(1) • to form calcium oxide (1) • {react (calcium oxide) with / add} water (1) • to form (solid) calcium hydroxide (1) • add (more) water / dissolve (calcium hydroxide) in water (1) • filter (1)	word/symbol equations could score marks **Reject** burning **Allow** quicklime **Allow** slaked lime	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(d)**	A description to include some of the following points: • formed from sediments / shells • sediments fall to the bottom of the sea • layers of sediment build up on top of one another • over (very) long time period • rock formed / compaction • (caused by)pressure (from the layers above and minerals) • (cause) the sediment to 'stick together' • (to form)layers • rock movement/change in sea level • (more recently) rock has been weathered / eroded (by sea) • because it is a soft rock	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. sediments fell to the bottom of the sea in layers • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. limestone is formed from sediments building up at the bottom of the sea in layers and is squashed to form rock • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. Sediments fall to the bottom of the sea and are compacted to form layers of rock , more rock builds up on top. Limestone is a soft rock and has been eroded by the sea. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)	Any **two** from the following: • fuels can be in different states / specific example • different sized molecules(1) • different viscosities (1) • different boiling point / vaporisation temperatures (1) • different ease of ignition /some fuels more flammable (1) • different amounts of air / oxygen needed (1)	different {thickness/runniness} some burn easier than others	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(c)	$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$ • reactant formulae (1) • product formulae (1) • balancing correct formulae (1)	**Ignore** state symbols balancing multiples	**(3)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	An evaluation including some of the following: **Advantages** • plenty of water / raw material • limited supplies of crude oil • hydrogen produces only water as waste • petrol produces carbon dioxide • carbon dioxide (emissions) may cause global warming **Disadvantages** • hydrogen has to be produced • requires energy / electricity to produce it • producing electricity from non-renewable sources produces carbon dioxide • expensive to produce • problems of storage of large volumes of flammable gas • stronger / heavier / bigger tanks needed • hydrogen a gas, petrol a liquid, hydrogen leaks more likely • limited outlets / conversion costs • shorter distance between refuelling	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. using petrol produces carbon dioxide which is a greenhouse gas. The only waste product from hydrogen is water • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. hydrogen is produced by electrolysis of water but electricity is expensive and its production damages the environment unless it is produced from renewable resources. Hydrogen only produces water when it is burnt. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. hydrogen is produced by electrolysis of water which is readily available but electricity is expensive and its production damages the environment unless it is produced from renewable resources. Hydrogen only produces water when it is burnt but petrol also produces carbon dioxide. Petrol is obtained from crude oil which is non-renewable. Hydrogen is a flammable gas which is difficult to store • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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