Write your name here

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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PEARSON

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)

.....

.....

(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)

.....

.....

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.....

(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

(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

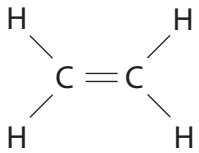
☒ **A** the number of hydrogen atoms in the molecule remains the same

☒ **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** $(CH_2)_n$

(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.

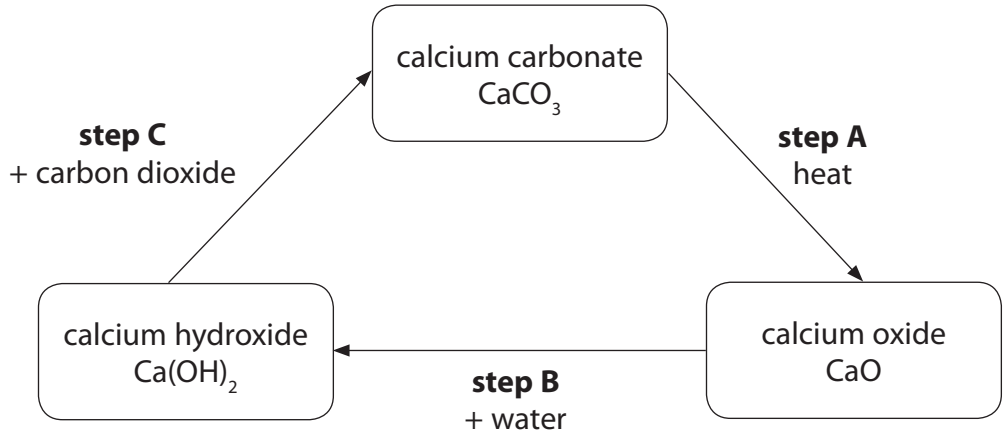
(a) Which row of the table correctly identifies chalk, marble and limestone as sedimentary or metamorphic rocks?

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)

.....

.....

.....

.....

(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)

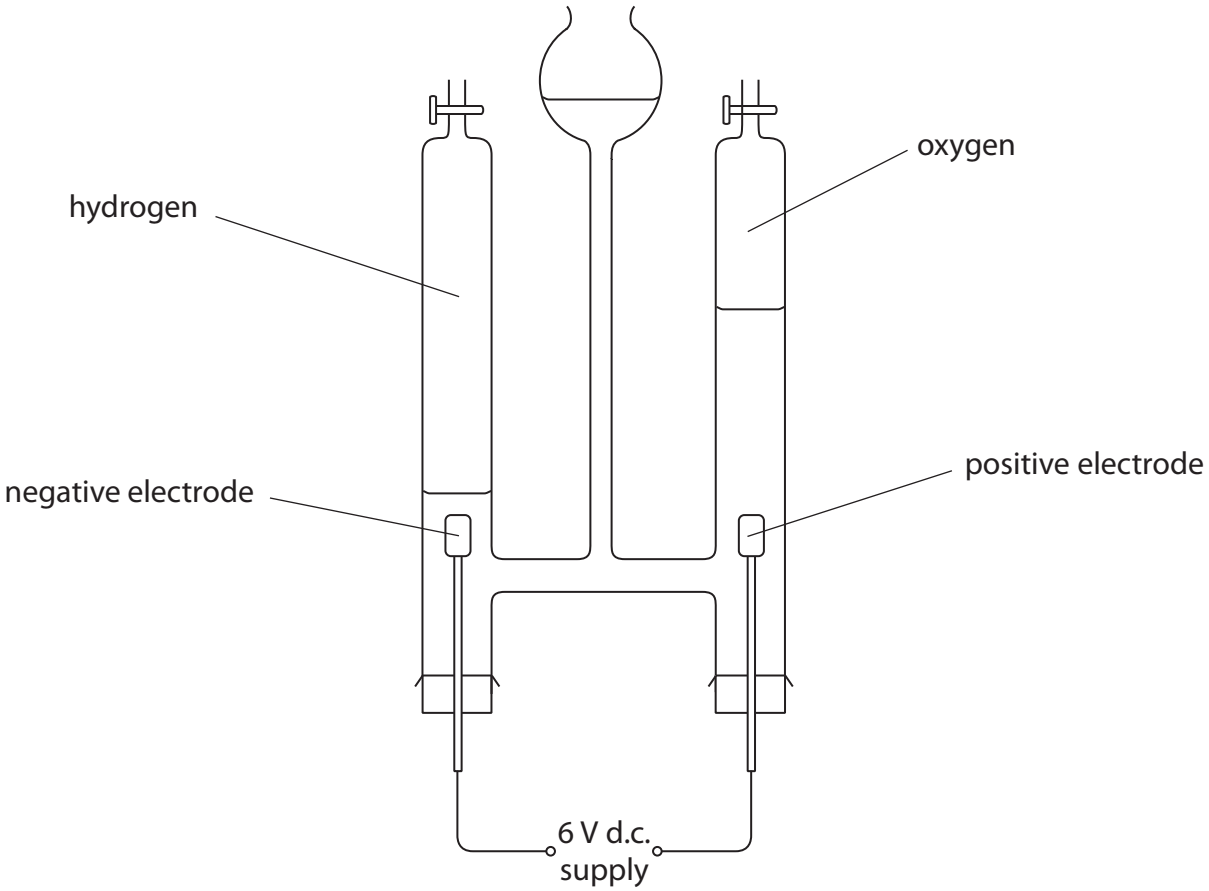
.....

(iv) Complete and balance the equation for the overall reaction taking place when sodium chloride solution is electrolysed.

(2)

..... NaCl + ... H_2O → ..... + ... + ...

*(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)

(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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