Surname	Centre Number	Candidate Number
Other Names		0

New GCSE

4472/02

ADDITIONAL SCIENCE
HIGHER TIER
CHEMISTRY 2

A.M. MONDAY, 21 May 2012

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	**7**	
2	**6**	
3	**6**	
4	**7**	
5	**8**	
6	**7**	
7	**5**	
8	**6**	
9	**8**	
Total	**60**	

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020001

ADDITIONAL MATERIALS

In addition to this paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

Assessment will take into account the quality of written communication (QWC) used in your answers to questions 2 and 8.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

Examiner only

Answer **all** *questions.*

1. This question is about the reactions of Group 1 metals.

(a) Group 1 metals are usually stored in liquid paraffin (oil).

Give **one** reason for storing these metals in this way. [1]

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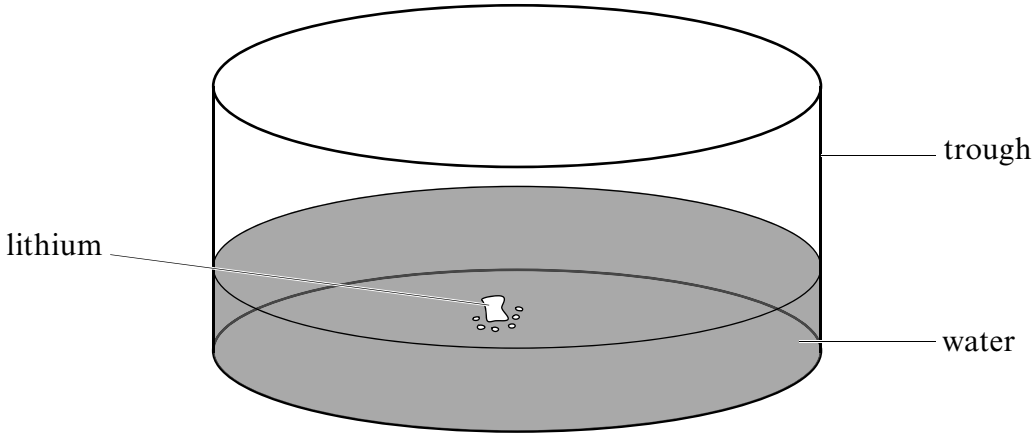
(b) The following diagram shows how lithium reacts with water.



(i) Apart from wearing goggles, give **one** safety precaution taken when carrying out this experiment. [1]

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(ii) Complete the following **word** equation for the reaction that takes place. [2]

lithium + water ⟶ ..... + ...

(iii) Name the **least** reactive metal in Group 1. [1]

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(iv) Describe what differences you would have observed if potassium had been added to the water in the trough instead of lithium. [2]

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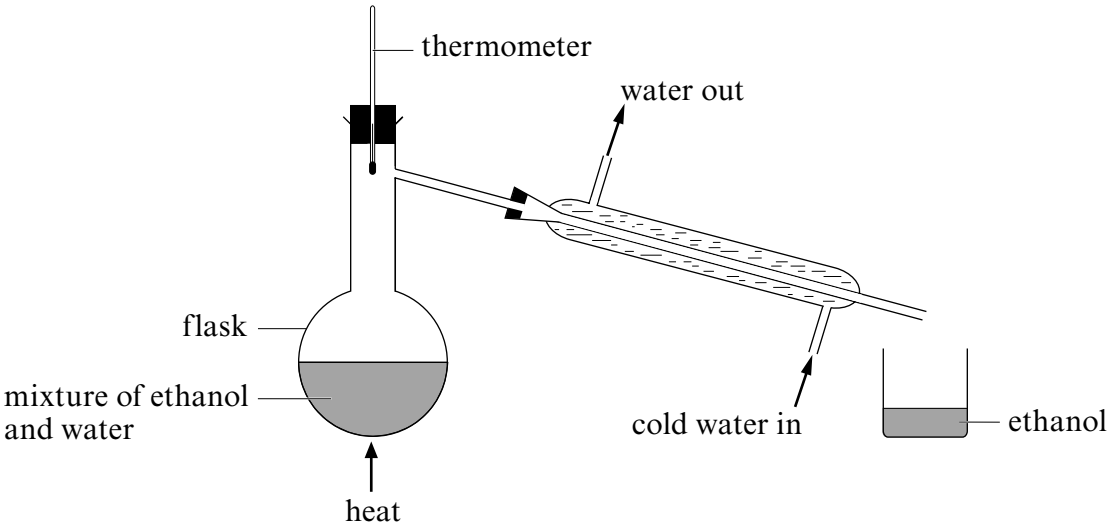
2. A mixture of ethanol and water can be separated by distillation.

A diagram of the apparatus which can be used is shown below.



Describe what happens during the process and explain how this method of separation works. [6 QWC]

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Turn over.

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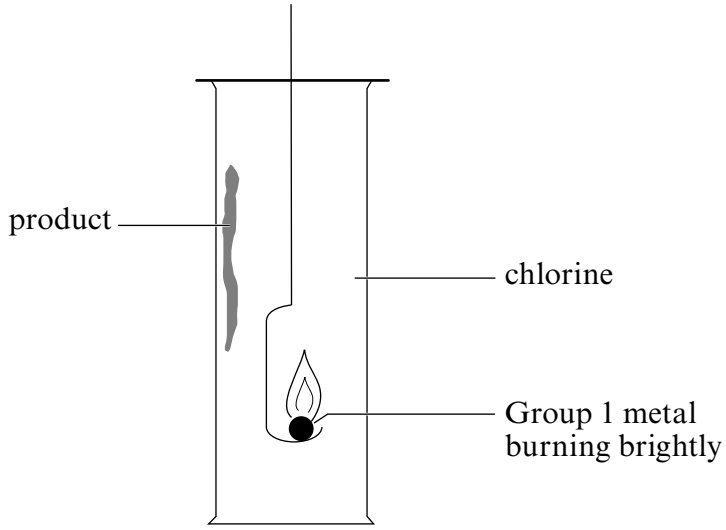
3. Group 1 metals react vigorously when heated and lowered into a gas jar of chlorine, Cl_2, as shown in the diagram below.



(a) When a flame test was carried out on the product of such a reaction a yellow flame was seen. Identify the Group 1 metal that was used. [1]

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(b) Give the balanced **symbol** equation for the reaction. [3]

..... + ... ⟶ .....

(c) Describe how you would test for chloride ions in a solution of the product, giving the expected observation. [2]

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4. The following table contains information about the numbers of particles contained within atoms and ions **A-F**.

A, **B**, **C**, **D**, **E** and **F** are **not** chemical symbols.

	A	**B**	**C**	**D**	**E**	**F**
Number of electrons	8	10	9	10	10	11
Number of neutrons	10	10	10	10	12	12
Number of protons	8	8	9	10	10	11

(a) State the atomic number of **C**. ..... [1]

(b) State the group and period of the Periodic Table to which **A** belongs. [1]

Group ..... *Period* .....

(c) (i) Choose the letter **A-F** which represents an ion. [1]

.....

(ii) Give the charge of this ion. ..... [1]

(d) Give the letter **A-F** which represents an atom/ion with a mass number of 20. [1]

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(e) Choose the letters **A-F** which represent isotopes and give the reason for your choice. [2]

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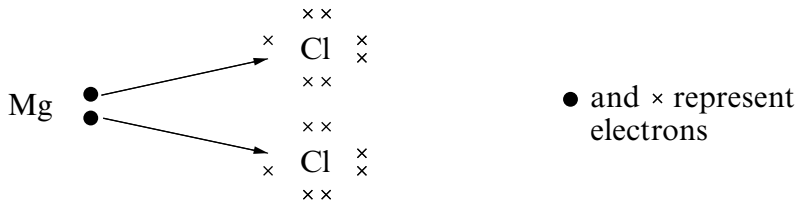
5. *(a)* The following diagram shows the transfer of electrons that takes place during the formation of magnesium chloride, $MgCl_2$.



(i) Name the type of bonding present in magnesium chloride. [1]

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(ii) State, giving a reason, what must be done to magnesium chloride so that it can conduct electricity. [2]

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(b) Using the electronic structures given below, show by means of a **diagram** the bonding in a molecule of carbon dioxide, CO_2. [2]

carbon (C) 2,4 oxygen (O) 2,6

(c) Carbon dioxide and diamond both contain covalent bonds.

Give the names of the different structure types and explain why diamond has a higher melting point than carbon dioxide. [3]

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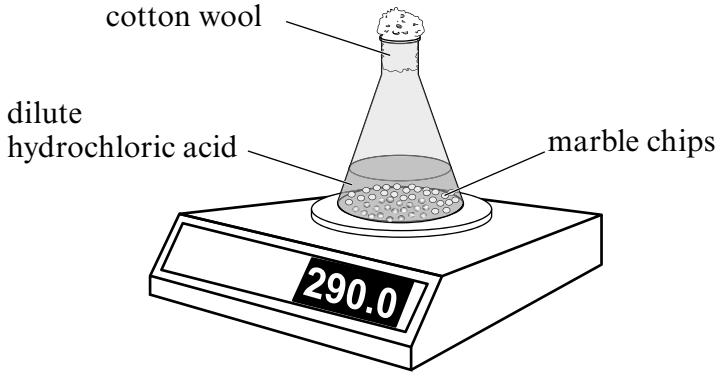
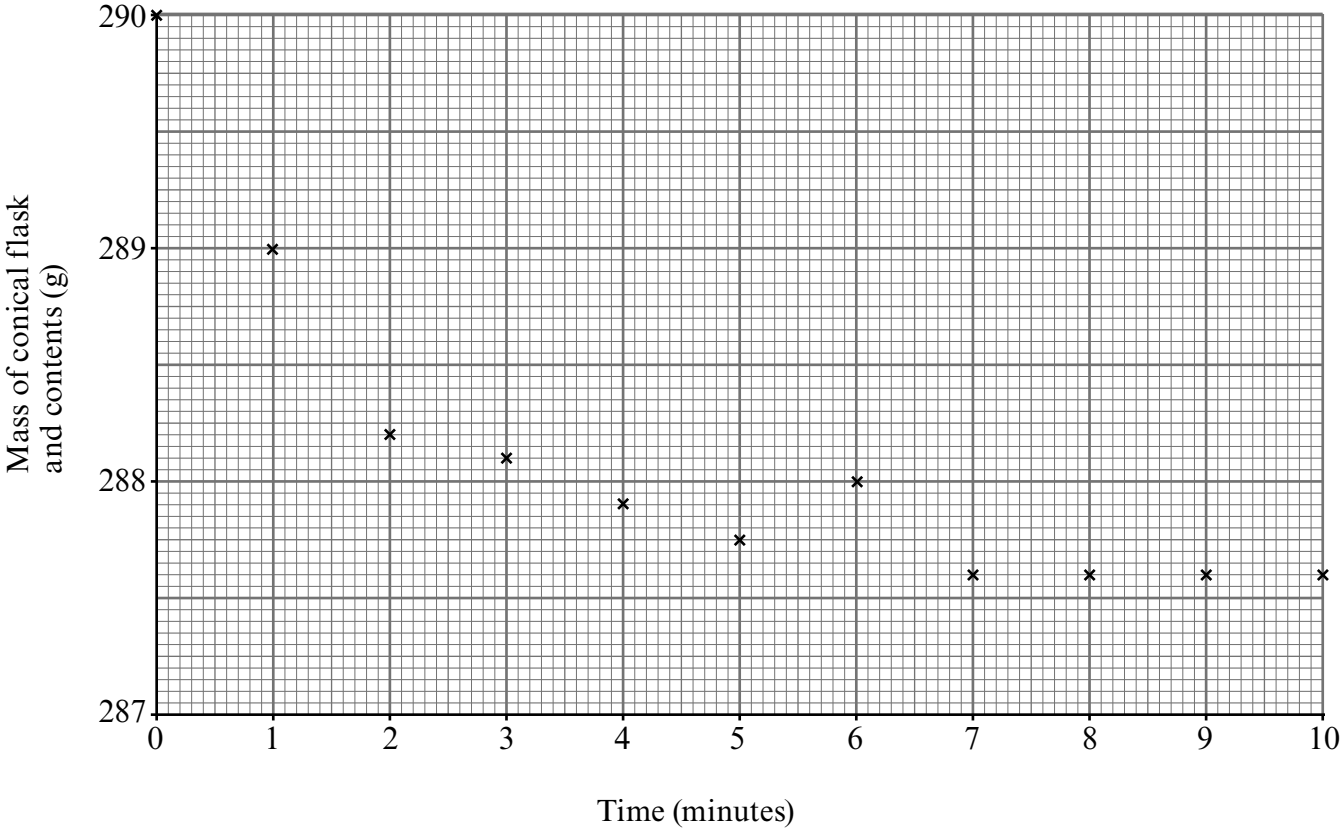
6. In order to study the effect of particle size on the rate of a reaction, marble chips (calcium carbonate) were reacted with *excess* dilute hydrochloric acid using the apparatus shown below.



The results were plotted on the graph below.



(a) Draw a line of best fit for the points plotted. [1]

(b) State why the mass decreases during the experiment. [1]

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(c) State the reason for placing cotton wool in the neck of the conical flask. [1]

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(d) The experiment was then repeated using the same mass of calcium carbonate powder instead of marble chips.

On the grid on the previous page, draw the curve you would expect to get. [2]

(e) The experiment was repeated once more, again using the same mass of calcium carbonate powder and the same volume of acid at half the concentration. The acid was still in excess. Give the total decrease in mass in this experiment and give a reason for your answer.

[2]

Decrease in mass = ... g

Reason .....

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7. *(a)* State what would be observed when ethene, C_2H_4, is bubbled into orange bromine water and name the type of reaction occurring. [2]

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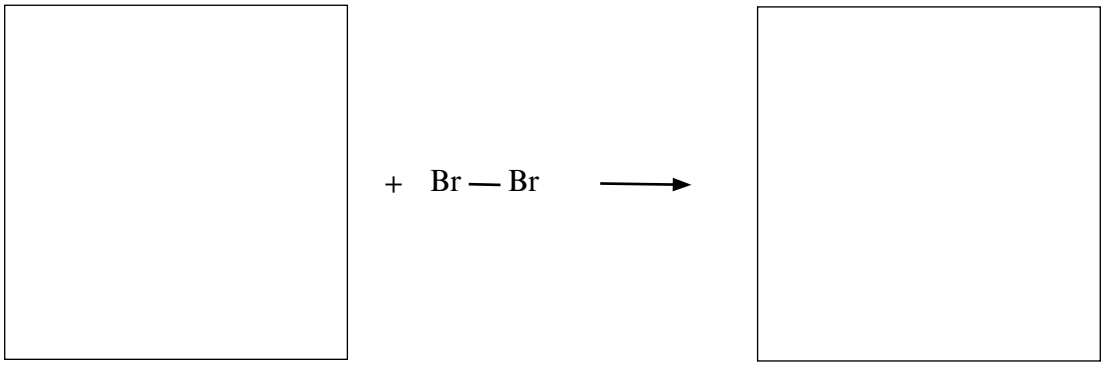
(b) Complete the following equation by drawing the **structural** formulae of ethene and the product of the reaction in part *(a)*. [2]



ethene bromine product

(c) Ethene undergoes a similar reaction with hydrogen.

Name the product of this reaction. ..... [1]

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8. Some areas of the United Kingdom have hard water while others have soft water.

Give a detailed account of your understanding of hardness in water. In your answer you should refer to the identification of hardness, its causes and its removal. [6 QWC]

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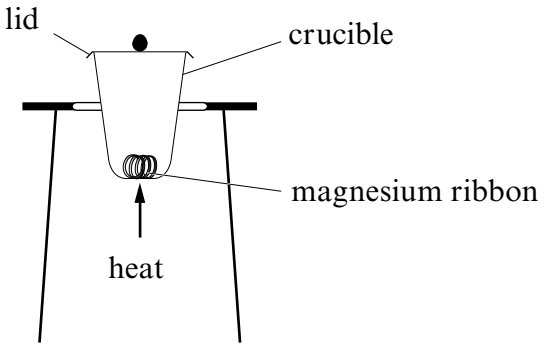
9. Magnesium burns in air with a bright white flame to give a white powder called magnesium oxide.

In order to work out the formula of magnesium oxide, Owain and Seren carried out an experiment using the apparatus shown in the diagram below.



The results of their experiment are shown below.

Mass of crucible and lid (g)	19.80
Mass of crucible, lid and magnesium (g)	20.28
Mass of crucible, lid and product after burning (g)	20.44

(a) Using Owain and Seren's results calculate the simplest formula for magnesium oxide. **Show your workings**. [3]

A_r(Mg) = 24 A_r(O) = 16

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(b) The formula calculated in part *(a)* raises a question about the data collected since the correct formula for magnesium oxide is MgO. Assuming no product was spilt and that all weighings were carried out correctly, suggest **two** reasons that could explain the unexpected results in this experiment. [2]

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(c) The balanced symbol equation for the burning of magnesium in air is given below.

$$2Mg + O_2 \longrightarrow 2MgO$$

Calculate the mass of magnesium oxide that should be produced when 0.48 g of magnesium is burned in air. [3]

$A_r(Mg) = 24$ $A_r(O) = 16$

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FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

Turn over.

PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}$H Hydrogen									$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulfur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key: