Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						4	3	3	5	/	2	H	Signature	

Paper Reference(s)

4335/2H

London Examinations IGCSE

Chemistry

Paper 2H

Higher Tier

Wednesday 21 May 2008 – Afternoon

Time: 2 hours

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
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9	
10	
11	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname and initial(s) and your signature.
The paper reference is shown at the top of this page. Check that you have the correct question paper.
Answer ALL the questions in the spaces provided in this question paper.
Show all stages in any calculations and state the units.
Calculators may be used.

Information for Candidates

The total mark for this paper is 120. The marks for parts of questions are shown in round brackets: e.g. **(2)**.
There are 28 pages in this question paper. All blank pages are indicated.
A Periodic Table is given on page 2.

Advice to Candidates

Write your answers neatly and in good English.

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THE PERIODIC TABLE

Period	1	2											3	4	5	6	7	0
	Group																	
1	1 H Hydrogen 1																	4 He Helium 2
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
3	23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
4	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
5	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 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
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 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	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Relative atomic mass
Symbol
Name
Atomic number

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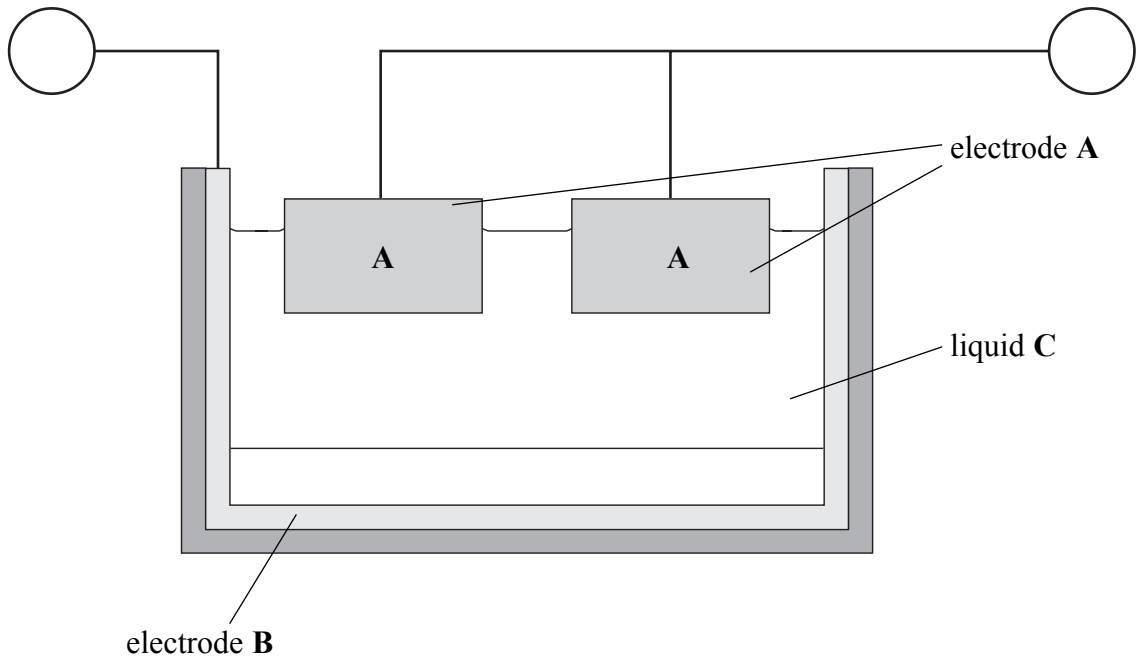
SECTION A

1. The diagram shows how aluminium is extracted on an industrial scale.



(a) (i) Name the process used to extract aluminium.

.....

.....

(1)

(ii) Name the material used for the electrodes **A** and **B**.

.....

(1)

(iii) Using the symbols + and – identify the polarity of the electrodes **A** and **B**.

Write **one** symbol in each circle in the diagram above.

(1)

(iv) Identify the **two** compounds present in liquid **C**.

1 .....

2 .....

(2)

(v) State **one** major cost that makes this process more expensive than the extraction of iron.

.....

(1)

Leave blank

(b) The mixture of gases coming from electrodes **A** contains an element and a compound.

(i) Identify the element.

.....

(1)

(ii) Identify the compound and explain how it forms.

Compound .....

Explanation of formation .....

.....

(2)

Q1

(Total 9 marks)

Leave blank

2. Ethene, C_2H_4, and methane, CH_4, are the first members of two different homologous series.

(a) One characteristic of a homologous series is that all its members have the same general formula.

(i) State **two** other characteristics of a homologous series.

1 .....

.....

2 .....

.....

(2)

(ii) What is the name of the homologous series to which ethene belongs?

.....

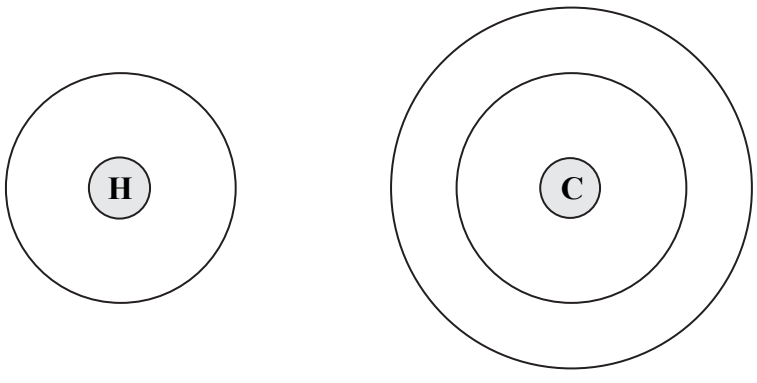
(1)

(iii) What is the general formula of this homologous series?

.....

(1)

(b) (i) Use the Periodic Table to help you complete the diagrams to show the electronic configuration of hydrogen and of carbon.



(2)

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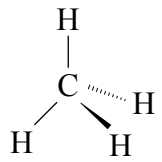
(ii) Draw a dot and cross diagram to show the covalent bonding in a methane molecule.

(2)

(iii) The shape of a methane molecule is shown in the following diagram.



What name describes this shape?

.....

.....

(1)

(c) The alkane C_4H_{10} exists as two isomers.

(i) What are isomers?

.....

.....

(2)

(ii) Draw the displayed formula of each isomer.

(2)

Q2

(Total 13 marks)

Leave blank

3. Calcium and magnesium are metals in Group 2 of the Periodic Table.

(a) (i) How many electrons are there in the outer shell of an atom of calcium?

.....

(1)

(ii) Write the electronic configuration of an atom of magnesium.

.....

(1)

(b) A student adds a piece of calcium to some cold water in a beaker. The products of the reaction are calcium hydroxide and hydrogen. Some of the calcium hydroxide dissolves in the water and some does not.

(i) Describe **two** observations that the student could make during the reaction.

1 .....

.....

2 .....

.....

(2)

(ii) Give the formula of calcium hydroxide.

.....

(1)

(iii) When the reaction is complete, a piece of litmus paper is added to the solution in the beaker. State the final colour of the litmus paper and what this colour indicates about the solution.

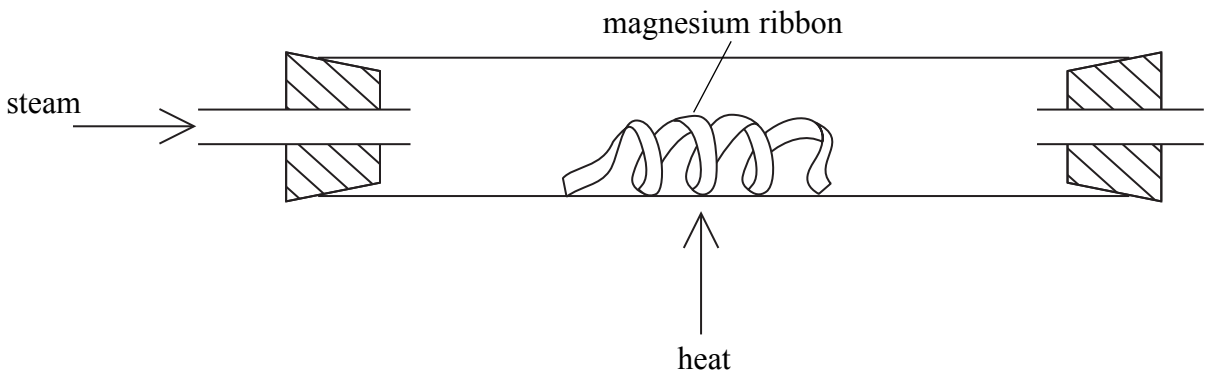
Final colour of litmus .....

What this colour indicates .....

(2)

Leave blank

(c) The diagram shows apparatus for reacting magnesium with steam.



The products of this reaction are magnesium oxide and hydrogen.

(i) State the colour of magnesium and of magnesium oxide.

Magnesium .....

Magnesium oxide .....

(2)

(ii) State **two** ways in which the hydrogen could be collected.

1 .....

.....

2 .....

.....

(2)

(iii) The hydrogen gas can be burned as it leaves the heated tube. Write a word equation for this reaction.

.....

(1)

Q3

(Total 12 marks)

Leave blank

4. A student has four solutions labelled **A**, **B**, **C** and **D**.
Each solution contains one compound from the following list:

KNO_3 $FeCl_2$ $Fe(NO_3)_3$ $CuSO_4$ NH_4Cl

The student does some simple tests to identify the compounds present.
The table shows the tests and observations.

Solution	Colour	Add sodium hydroxide solution	Add dilute nitric acid and silver nitrate solution
A	colourless	pungent gas given off	white precipitate
B	blue	blue precipitate	no change
C	colourless	no change	no change
D	green	green precipitate	white precipitate

(a) (i) What is the pungent gas formed by solution **A**?

.....

(1)

(ii) Which ion must be present in **A** for the white precipitate to form?

.....

(1)

(iii) Which ion must be present in **B** for the blue precipitate to form?

.....

(1)

(iv) Which ion must be present in **D** for the green precipitate to form?

.....

(1)

(b) (i) Which compound in the list can be identified using barium chloride solution?

.....

(1)

(ii) State **one** compound in the list that can be identified using a flame test.
State the colour of the flame.

Compound .....

Flame colour .....

(2)

Leave blank

(c) Silver nitrate solution, $AgNO_3(aq)$, is added to a solution of lithium iodide, LiI.

(i) Describe what is seen.

.....

.....

(1)

(ii) Write the chemical equation, including state symbols, for the reaction.

.....

.....

(3)

Q4

(Total 11 marks)

TOTAL FOR SECTION A: 45 MARKS

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SECTION B

5. (a) A crystal of copper(II) sulphate is dropped into a test tube full of water. The crystal sinks to the bottom and starts to dissolve, turning the water blue.

(i) Name the process that occurs after the copper(II) sulphate has dissolved.

.....

(1)

(ii) Describe how this process occurs.

.....

.....

(2)

(b) A sample of the solution is removed from the test tube. Dilute ammonia solution is slowly added to the sample until in excess.

(i) Describe what you would see as ammonia solution is added.

.....

.....

.....

(3)

(ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution.

.....

(1)

Q5

(Total 7 marks)

Leave blank

6. (a) (i) Describe what is seen when a small piece of sodium is dropped onto water.

.....

.....

.....

.....

.....

(3)

(ii) Write a chemical equation for the reaction.

.....

(2)

(iii) Give **one** observation that will be different if rubidium is used in place of sodium.

.....

(1)

(b) Sodium reacts readily with oxygen to form the ionic compound sodium oxide.

(i) The diagram shows the electron configuration of an atom of sodium and an atom of oxygen. Describe, in terms of electrons, what happens when sodium atoms react with oxygen atoms.

.....

.....

.....

.....

.....

.....

(3)

Leave blank

(ii) Sodium oxide has a melting point of 1275 °C. Explain why sodium oxide has a high melting point.

.....

.....

.....

.....

(3)

(iii) Magnesium oxide, MgO, has a melting point of 2852 °C. Suggest why magnesium oxide has a higher melting point than sodium oxide.

.....

.....

.....

(2)

Q6

(Total 14 marks)

Leave blank

7. (a) Magnesium chloride is a soluble salt that can be made by reacting magnesium carbonate with dilute hydrochloric acid. Magnesium carbonate is insoluble in water.

Describe how you could make a dry sample of magnesium chloride crystals from magnesium carbonate and dilute hydrochloric acid.

.....

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.....

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.....

(5)

(b) 25.0 cm^3 of dilute sulphuric acid are placed in a conical flask. A few drops of phenolphthalein indicator are added. The acid requires 8.70 cm^3 of sodium hydroxide solution of concentration 0.150 mol dm^{-3} for neutralisation.
The chemical equation for the reaction is

$$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$$

(i) What colour change is seen when the acid is neutralised?

.....

(2)

(ii) Calculate the amount, in moles, of sodium hydroxide used.

(2)

Leave blank

(iii) Calculate the amount, in moles, of sulphuric acid used.

(1)

(iv) Calculate the concentration, in mol dm^{-3}, of the sulphuric acid.

(1)

Q7

(Total 11 marks)

Leave blank

8. A student notices a white solid around the top of a bottle of dilute sodium hydroxide solution. She suspects that the solid is sodium carbonate.

(a) (i) Describe the test, and the positive result expected, that she can do to see if the solid is a carbonate.

.....

.....

.....

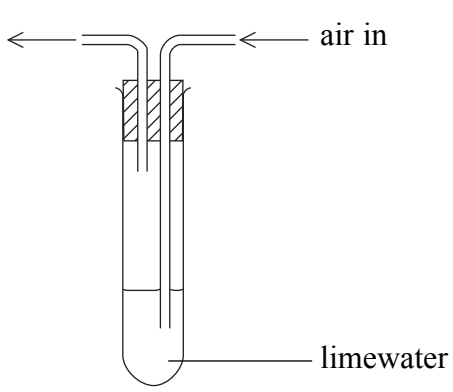
(2)

(ii) Carbon dioxide reacts with sodium hydroxide solution to form sodium carbonate and water. Write a chemical equation for this reaction.

.....

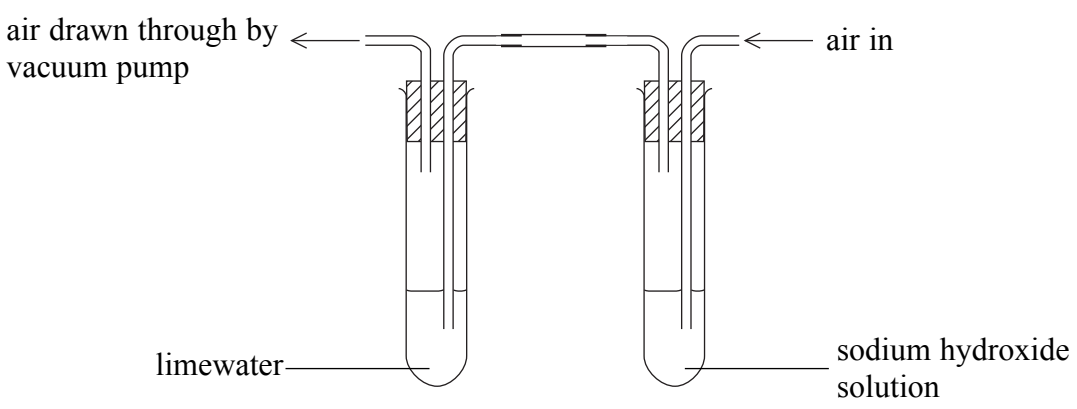
(2)

(b) Air is passed through limewater using the apparatus shown.



After a few minutes the limewater becomes milky.

The experiment is repeated using the following apparatus



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What happens, if anything, to the limewater after a few minutes? Explain your answer.

.....

.....

.....

(2)

(c) Sodium carbonate is also formed when sodium hydrogencarbonate is heated strongly. The chemical equation for the reaction is

$$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

4.2 g of sodium hydrogencarbonate is heated until it is fully decomposed.

(i) Calculate the amount, in moles, of sodium hydrogencarbonate used.

(3)

(ii) Calculate the amount, in moles, of carbon dioxide formed.

(1)

(iii) Calculate the volume, in dm^3, measured at room temperature and pressure (rtp), of carbon dioxide formed.
The volume of one mole of any gas at rtp is 24 dm^3.

(1) **Q8**

(Total 11 marks)

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9. The table gives some information about elements in Group 7 of the Periodic Table.

Name	State at room temperature	Boiling point / °C
chlorine	gas	–35
bromine	liquid	
iodine	solid	184

(a) Use the information in the table to predict the boiling point of bromine.

.....

(1)

(b) If a mixture of hydrogen and chlorine is exposed to sunlight a violent reaction takes place. The only product is hydrogen chloride.

(i) Write a chemical equation for the reaction.

.....

(2)

(ii) A teacher bubbles hydrogen chloride gas into separate samples of water and methylbenzene. She then tests each liquid with universal indicator paper. Describe and explain what is seen in each case.

Hydrogen chloride in water

.....

.....

.....

Hydrogen chloride in methylbenzene

.....

.....

.....

(4)

Q9

(Total 7 marks)

Leave blank

10. The list gives the order of reactivity of some metals.

most reactive	↑	magnesium
		zinc
		iron
		copper
least reactive		silver

(a) Iron is sometimes coated with zinc to prevent the iron rusting. The iron does not rust even if the coating of zinc becomes damaged.

(i) What is the name given to this method of rust prevention?

.....

(1)

(ii) Give **one** example where this method of rust prevention is used.

.....

(1)

(iii) Explain how this method of rust prevention works.

.....

.....

.....

(2)

(b) A student is given some solid nickel nitrate and several small pieces of magnesium, zinc, iron, copper and silver. Describe and explain how he can find the position of nickel in the reactivity series given above.

.....

.....

.....

.....

.....

(3)

Leave blank

(c) When nickel nitrate solution is electrolysed the product at one electrode is nickel.

The ionic half-equation for this reaction is

$$Ni^{2+}(aq) + 2e^- \rightarrow Ni(s)$$

(i) Explain whether nickel ions are oxidised or reduced in this reaction.

.....

.....

(1)

(ii) A sample of nickel nitrate solution was electrolysed using a current of 1.5 A for 160 s. Calculate the mass of nickel formed.
One faraday is 96 000 coulombs.

(4)

Q10

(Total 12 marks)

Leave blank

11. (a) Ethanol can be dehydrated to form ethene.

$$C_2H_5OH \rightleftharpoons C_2H_4 + H_2O \qquad \Delta H = +35 \text{ kJ/mol}$$

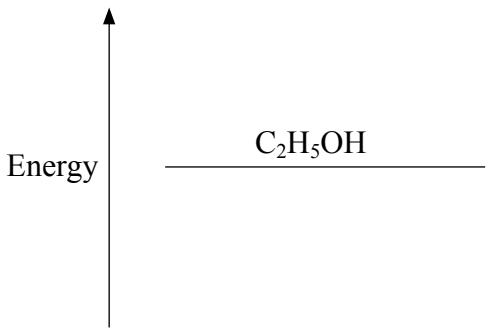
(i) What conditions are required for this reaction?

.....

.....

(2)

(ii) Complete and label the energy profile for this reaction.



(2)

(iii) State, with a reason, the effect of increasing the temperature on the equilibrium yield of C_2H_4.

.....

.....

.....

(2)

(b) Ethene forms an addition polymer, poly(ethene).

Draw the structure of poly(ethene), showing at least 4 carbon atoms in your structure.

(2)

Leave blank

(c) An organic compound has the composition 38.7% carbon, 9.70% hydrogen and 51.6% oxygen by mass. The relative formula mass of the compound is 62. Calculate the empirical and molecular formulae of the compound.

(5) **Q11**

(Total 13 marks)

TOTAL FOR SECTION B: 75 MARKS

TOTAL FOR PAPER: 120 MARKS

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