Centre No.						Surname	Initial(s)
Candidate No.						Signature	

Paper Reference(s)

4335/2H

London Examinations IGCSE

Chemistry

Paper 2H

Higher Tier

Monday 9 May 2005 – Morning

Time: 2 hours

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number and candidate number, your surname, initial(s) and 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 book.
Show all the steps 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 24 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.

Printer's Log. No.
N21055A
W850/U4335/57570 5/4/4/3/2/1800

N 2 1 0 5 5 A

Turn over

edexcel INTERNATIONAL

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 Indium 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

Leave blank

SECTION A

1. This question is about the properties and uses of some everyday materials.

Here is a list of possible uses for different materials, and a list of properties.

Use
coins
injection moulding of bottles
insulation on electrical wires
overhead electricity cables
railway tracks
window frames

Property
brittle
does not conduct electricity
good conductor of electricity
low melting point
resists corrosion
strong

Write **one** use for each material in the table. For each use, give a related property.

Each use and property may be used once, more than once or not at all.

Material	Use	Property
aluminium		
copper		
poly(chloroethene)		
poly(ethene)		
steel (contains iron)		

Q1

(Total 5 marks)

Leave blank

2. A mixture contains an insoluble compound and a soluble compound.
The mixture is separated by adding hot water and then filtering.
This produces a **white** solid, **A**, and a **green** solution, **B**.

The white solid and the green solution were tested to find out what they were. The tables show the tests used and the results.

Tests on white solid A	
Test	**Result**
Carry out flame test	The flame was coloured brick red
Add dilute hydrochloric acid Test the gas produced	Bubbles seen Found to be carbon dioxide

(a) (i) **Name** the cation in solid **A**.

.....

(1)

(ii) The gas produced is carbon dioxide.

Give the test for carbon dioxide.

.....

Give the result of this test.

.....

(2)

(iii) **Name** the anion in solid **A**.

.....

(1)

Leave blank

Tests on green solution B	
Test	**Result**
Add sodium hydroxide solution	Green precipitate
Add dilute nitric acid Then add silver nitrate solution	No change No change
Add barium chloride solution Then add dilute hydrochloric acid	White precipitate No change

(b) (i) Give the **formula** of the cation in solution **B**.

.....

(1)

(ii) Give the **name** of the green precipitate.

.....

(1)

(iii) **Name** the anion in solution **B**.

.....

(1)

(iv) Give the **formula** of the white precipitate.

.....

(1)

(c) There are three anions that give a precipitate when dilute nitric acid and silver nitrate solution are added. Name **two** of these anions.

.....

.....

(2)

(d) (i) Give the **formula** of solid **A**.

.....

(1)

(ii) Give the **formula** of the compound in solution **B**.

.....

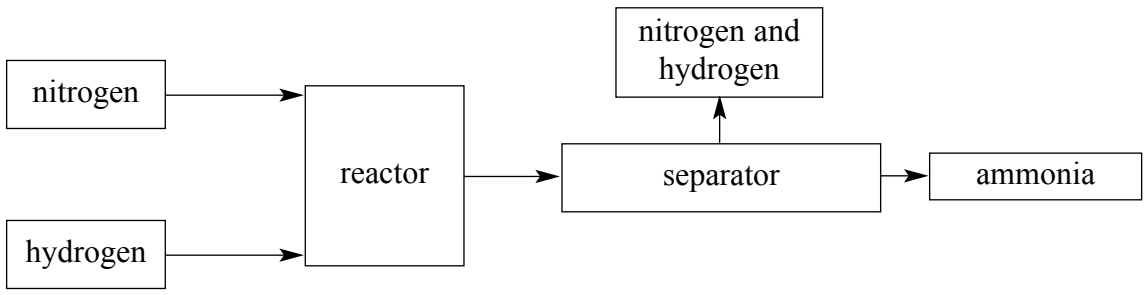
(1)

Q2

(Total 12 marks)

Leave blank

3. (a) Ammonia is made industrially by the Haber process. In this process nitrogen is reacted with hydrogen. The flow diagram shows what happens in the Haber process.



(i) Give the names of the raw materials from which the nitrogen and hydrogen are obtained.

Raw material from which nitrogen is obtained .....

Raw material from which hydrogen is obtained .....

(2)

(ii) State the conditions used in the reactor.

.....

.....

.....

(3)

(iii) How is the ammonia separated from the unreacted nitrogen and hydrogen?

.....

(1)

(iv) What is done with the unreacted nitrogen and hydrogen?

.....

(1)

(b) Ammonium nitrate can be used as a fertiliser to increase plant growth. It is made by reacting ammonia solution with nitric acid. Write a chemical equation for this reaction.

.....

(2)

Q3

(Total 9 marks)

Leave blank

4. Crude oil is a mixture of hydrocarbons. The mixture can be separated into fractions by the process of fractional distillation.

(a) Fractional distillation of crude oil produces the fractions bitumen, diesel, fuel oil, gasoline, kerosene and refinery gases.

State **one** use of bitumen and **one** use of kerosene.

Use of bitumen .....

Use of kerosene .....

(2)

(b) Gasoline is used as a fuel for cars. When gasoline undergoes complete combustion the products are carbon dioxide and water.

(i) Write a word equation for the complete combustion of gasoline.

.....

(1)

(ii) In car engines, incomplete combustion takes place.
Why is the combustion incomplete?

.....

(1)

(iii) Explain why the incomplete combustion of gasoline can be harmful to humans.

.....

.....

.....

(3)

(c) Fractional distillation works because each fraction has a different boiling range.

Describe how you could obtain a fraction with a boiling range of 80 °C to 120 °C **in the laboratory** from a sample of crude oil. Name the items of apparatus you would need.

.....

.....

.....

.....

.....

.....

(3)

Q4

(Total 10 marks)

Leave blank

5. This question is about the synthetic polymer nylon.

(a) Poly(ethene) is an addition polymer. What type of polymer is nylon?

.....

(1)

(b) Nylon can be made using the monomers **A** and **B** represented in the diagrams.

monomer **A** monomer **B**

(i) What type of compound is monomer **A**?

.....

(1)

(ii) What type of compound is monomer **B**?

.....

(1)

(iii) Draw a diagram to show the structure of the polymer formed from **A** and **B**. You must draw enough of the structure to make the repeat unit clear.

(3)

(c) Nylon has a simple molecular structure. Use words from the box to complete the sentences.

Each word may be used once, more than once or not at all.

ions	**high**	**low**
molecules	**strong**	**weak**

Nylon has a ..... melting point. This is because there are

..... forces between the ..... that make up

the structure.

(3)

Q5

(Total 9 marks)

TOTAL FOR SECTION A: 45 MARKS

BLANK PAGE

Leave blank

SECTION B

6. A sample of the element rubidium, Rb, contains two isotopes.

(a) Explain what isotopes are.

.....

.....

(2)

(b) (i) Complete the table for the isotopes of rubidium.

Atomic number of isotope	Mass number of isotope	Number of protons	Number of neutrons	Percentage of each isotope in sample
37	85			72
		37	50	28

(3)

(ii) Use the table to calculate the relative atomic mass of the sample of rubidium. Give your answer to one decimal place.

.....

.....

.....

.....

(2)

(c) Why do the two isotopes of rubidium have the same chemical properties?

.....

.....

(1)

Leave blank

(d) Rubidium reacts with oxygen, chlorine and water in a similar way to other Group 1 elements.

(i) Suggest the formula of the compound formed when rubidium reacts with:

oxygen .....

chlorine .....

(2)

(ii) A small piece of rubidium is added to a trough of water.

Suggest two observations you could make during the reaction.

1 .....

.....

2 .....

.....

(2)

(iii) Complete and balance the equation for the reaction of rubidium with water.

$Rb + \quad H_2O \rightarrow$

(2)

Q6

(Total 14 marks)

Leave blank

7. (a) Chlorine gas can be prepared in the laboratory using concentrated hydrochloric acid and $KMnO_4(s)$.

State the name of $KMnO_4(s)$ and describe its function in the preparation.

Name .....

Function .....

(2)

(b) Some chlorine gas is bubbled into a solution containing potassium iodide.
A displacement reaction occurs.

(i) Write an ionic equation for the reaction.

.....

.....

(1)

(ii) What colour is the solution at the end of the reaction?

.....

(1)

(iii) Explain why no displacement reaction occurs when iodine is added to a solution of potassium chloride.

.....

.....

(1)

(c) Hydrogen chloride can be made using the reaction

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

Describe the colour change seen during this reaction.

.....

.....

(2)

Leave blank

(d) Draw a dot-and-cross diagram to show all the outer electrons in a molecule of hydrogen chloride.

(2)

(e) (i) Some hydrogen chloride gas was dissolved in water.
A piece of blue litmus paper was placed in the solution.

State, with a reason, the final colour of the litmus paper.

.....

.....

(2)

(ii) Some hydrogen chloride gas was dissolved in methylbenzene.
A piece of blue litmus paper was placed in the solution.

State, with a reason, the final colour of the litmus paper.

.....

.....

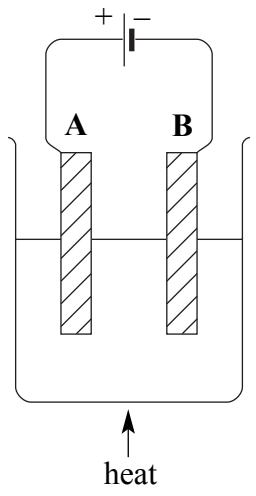
(2)

Q7

(Total 13 marks)

Leave blank

8. The diagram shows the apparatus used to electrolyse lead(II) bromide.



(a) The wires connected to the electrodes are made of copper.

Explain why copper conducts electricity.

.....

.....

(1)

(b) Explain why electrolysis does not occur unless the lead(II) bromide is molten.

.....

.....

(2)

(c) The reactions occurring at the electrodes can be represented by the equations shown in the table.

Complete the table to show the electrode (**A** or **B**) at which each reaction occurs, and the type of reaction occurring (oxidation or reduction).

Electrode reaction	Electrode	Type of reaction
$Pb^{2+} + 2e^- \rightarrow Pb$		
$2Br^- \rightarrow Br_2 + 2e^-$		

(2)

Leave blank

(d) In an experiment using the same apparatus, the amount of charge passed was 0.10 faraday.

(i) Calculate the maximum amount, in moles, of each substance formed.

Amount of Pb .....

Amount of Br_2 .....

(2)

(ii) Calculate the mass of bromine formed.

.....

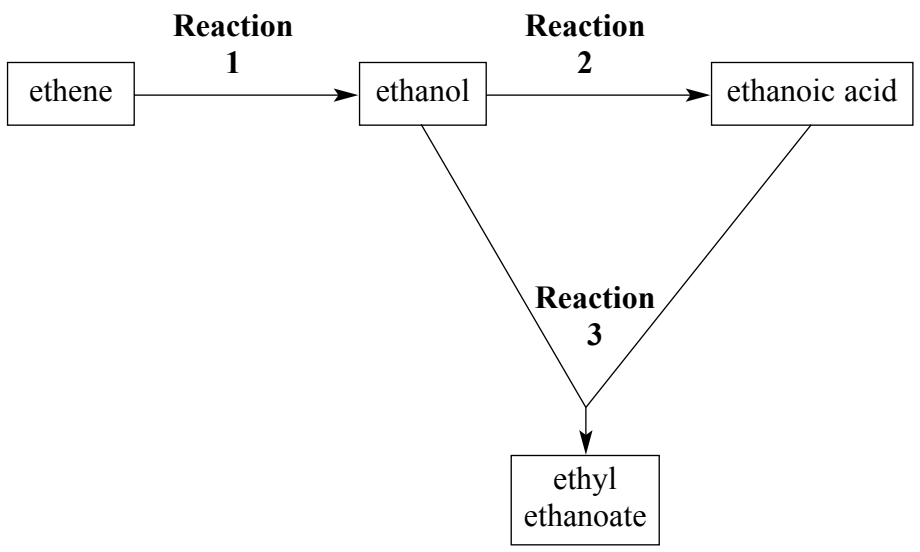
.....

(2) **Q8**

(Total 9 marks)

Leave blank

9. This question refers to the following reaction scheme.



(a) Draw the displayed formula of ethene.

(1)

(b) State the other reagent, and the conditions needed, for **Reaction 1**.

.....

.....

.....

(3)

(c) Ethanol can also be made from $C_{12}H_{22}O_{11}(s)$.

(i) What type of substance is $C_{12}H_{22}O_{11}(s)$?

.....

(1)

(ii) What type of reaction is used to make ethanol from this substance?

.....

(1)

Leave blank

(d) State the type of reaction occurring in **Reaction 2** and suggest suitable reagents.

.....

.....

.....

.....

(3)

(e) The organic product of **Reaction 3** is a member of a homologous series.

(i) State the name of the homologous series to which this substance belongs.

.....

(1)

(ii) Explain what is meant by a homologous series.

.....

.....

(2)

Q9

(Total 12 marks)

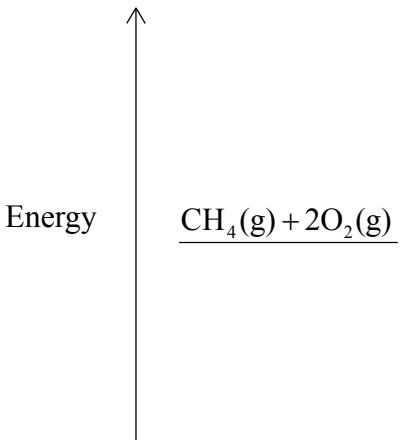
Leave blank

10. A common example of an exothermic reaction is the complete combustion of methane, as shown in the equation.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

(a) This reaction can be represented by an energy level diagram.

Complete the diagram by showing the products of the reaction.



(1)

(b) The table shows the values of some average bond dissociation energies.

Bond	C—H	O—H	O═O	C═O
Dissociation energy (kJ/mol)	412	463	496	743

Methane and water contain only single bonds. Oxygen and carbon dioxide contain only double bonds.

Use the values in the table to calculate the energy change occurring during the complete combustion of methane.

.....

.....

.....

.....

(3)

Leave blank

(c) At room temperature the reaction between methane and oxygen is very slow.

State **three** different changes in conditions that would increase the rate of this reaction.

1 .....

2 .....

3 .....

(3)

(d) Another reaction of methane, used in industry, is shown by the equation

$$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g) \qquad \Delta H = +210 \text{ kJ/mol}$$

(i) What do the symbols $\rightleftharpoons$ and ΔH represent?

$\rightleftharpoons$ .....

ΔH .....

(2)

(ii) The reaction is carried out at 2 atm pressure and 1000 °C.

Predict what would happen to the amounts of carbon monoxide and hydrogen formed if these conditions were changed as follows.

Pressure increased .....

.....

Temperature decreased .....

.....

(2)

Q10

(Total 11 marks)

Leave blank

11. (a) A student made a solution of potassium hydroxide by dissolving 14.0 g of solid potassium hydroxide in distilled water to make 250 cm^3 of solution.

(i) Calculate the relative formula mass of potassium hydroxide, KOH.

.....

.....

(1)

(ii) Calculate the amount, in moles, of potassium hydroxide in 14.0 g.

.....

.....

(1)

(iii) Calculate the concentration, in mol dm^{-3}, of this solution of potassium hydroxide. Show your working.

.....

.....

(2)

Leave blank

(b) A different solution of potassium hydroxide, of concentration 2.0 mol dm^{-3}, was used in an experiment to react with carbon dioxide gas.

The equation for this reaction is

$$2KOH(aq) + CO_2(g) \rightarrow K_2CO_3(aq) + H_2O(l)$$

(i) Calculate the amount, in moles, of potassium hydroxide in 200 cm^3 of this solution.

.....

.....

(1)

(ii) Calculate the amount, in moles, of carbon dioxide that reacts with 200 cm^3 of this solution of potassium hydroxide.

.....

.....

(1)

(iii) Calculate the volume that this amount of carbon dioxide occupies at room temperature and pressure (rtp).
(molar volume of any gas = 24 dm^3 at rtp)

.....

.....

(1)

Q11

(Total 7 marks)

Leave blank

12. Diamond and graphite are different forms of carbon.

(a) State the term used to describe different forms of the same element in the same physical state.

.....

(1)

(b) Name and describe the type of **bonding** in diamond.

.....

.....

.....

.....

.....

.....

(3)

(c) State one industrial use of diamond.

.....

(1)

(d) Graphite has a hexagonal layer structure. Draw a diagram, showing three hexagons, to show the atoms and bonding in graphite.

(2)

Leave blank

(e) Diamond and graphite both have high sublimation points. Explain why.

.....

.....

.....

.....

(2) **Q12**

(Total 9 marks)

TOTAL FOR SECTION B: 75 MARKS

END

BLANK PAGE