

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

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Team Leader's use only

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Question Number	Leave Blank
1	
2	
3	
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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.

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THE PERIODIC TABLE

		Group											
		1	2	3	4	5	6	7	0				
Period	1										4 He Helium 2		
	2												
1											1 H Hydrogen 1		
2	7	9										20 Ne Neon 10	
		23	24										19 F Fluorine 9
3	8	11	12	13	14	15	16	17	18				
		27	28	29	30	31	32	33	34	35	36		
4	9	12	13	14	15	16	17	18	19	20	21		
		39	40	41	42	43	44	45	46	47	48		
5	10	13	14	15	16	17	18	19	20	21	22		
		87	88	89	90	91	92	93	94	95	96		
6	11	15	16	17	18	19	20	21	22	23	24		
		133	137	139	140	141	142	143	144	145	146		
7	12	17	18	19	20	21	22	23	24	25	26		
		223	226	227	228	229	230	231	232	233	234		

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

(Total 5 marks)

Q1

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)

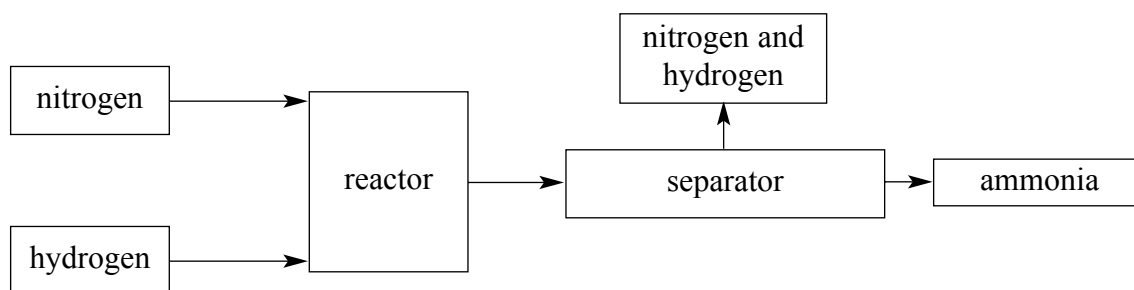
(ii) Give the **formula** of the compound in solution B.

..... (1)

(Total 12 marks)

Q2

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)

(Total 10 marks)

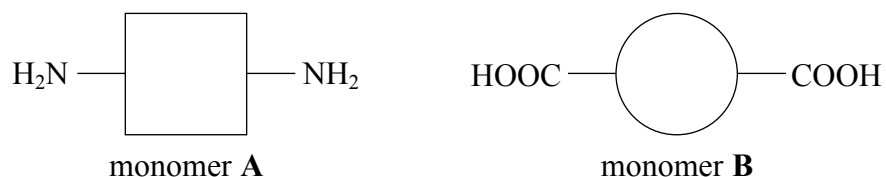
Q4

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.



(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

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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

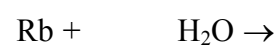
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2

.....

(2)

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



(2)

Q6

(Total 14 marks)

7. (a) Chlorine gas can be prepared in the laboratory using concentrated hydrochloric acid and $\text{KMnO}_4(\text{s})$.

State the name of $\text{KMnO}_4(\text{s})$ 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?

.....

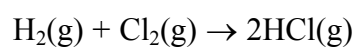
(1)

(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



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.

.....

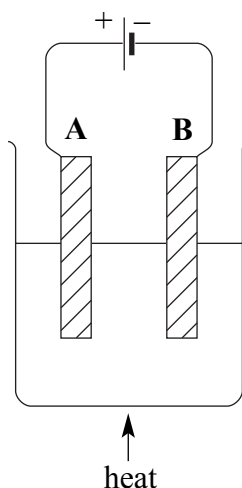
.....

(2)

Q7

(Total 13 marks)

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
$\text{Pb}^{2+} + 2\text{e}^{-} \rightarrow \text{Pb}$		
$2\text{Br}^{-} \rightarrow \text{Br}_2 + 2\text{e}^{-}$		

(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 Br₂ (2)

(ii) Calculate the mass of bromine formed.

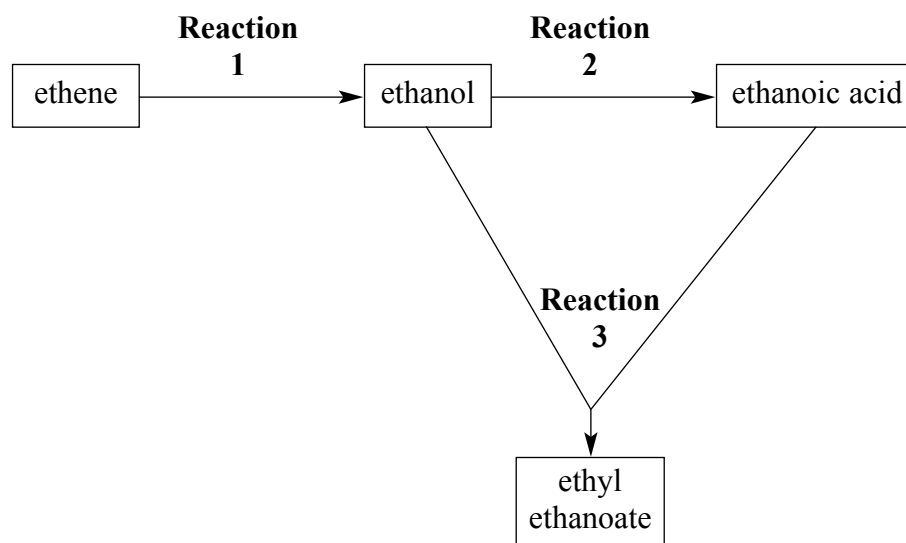
.....

..... (2)

(Total 9 marks)

Q8

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.

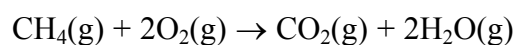
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(2)

(Total 12 marks)

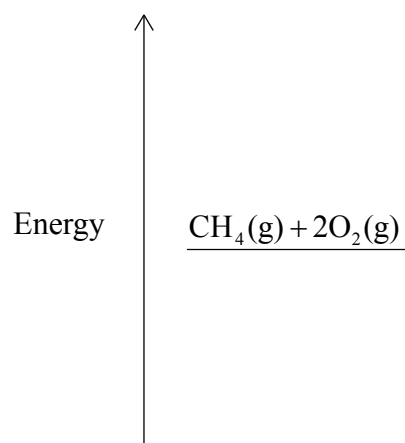
Q9

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



(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



(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)

(Total 11 marks)

Q10

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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 cm³ 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)

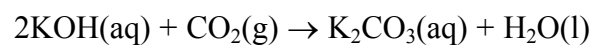
(iii) Calculate the concentration, in mol dm⁻³, of this solution of potassium hydroxide. Show your working.

.....
.....
(2)

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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



- (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)

(Total 7 marks)

Q11

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)

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

.....
.....
.....
.....

(2)

(Total 9 marks)

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blank

Q12

TOTAL FOR SECTION B: 75 MARKS

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