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

Paper Reference(s)

4437/5H

London Examinations IGCSE

Science (Double Award)

Chemistry

Paper 5H

Higher Tier

Tuesday 7 November 2006 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
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 question paper.
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 90. The marks for parts of questions are shown in round brackets: e.g. (**2**).
A Periodic Table is given on page 2.
This paper has 10 questions. All blank pages are indicated.

Advice to Candidates

Write your answers neatly and in good English.

Printer's Log. No.
N23881A
W850/U4437/57570 3/3/3/4/4/400

N 2 3 8 8 1 A 0 1 2 0

Turn over

edexcel
advancing learning, changing lives

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. (a) In industry, chlorine and sodium hydroxide are manufactured from brine.

(i) Name the compound in brine that is the source of chlorine.

.....

(1)

(ii) What method is used to obtain chlorine and sodium hydroxide from brine?

.....

(1)

(iii) State **one** large-scale use of sodium hydroxide.

.....

.....

(1)

(b) What colour is chlorine gas?

.....

(1)

(c) Damp red litmus paper changes colour when placed in separate samples of chlorine and sodium hydroxide.

(i) State the colour of red litmus paper in chlorine gas.

.....

(1)

(ii) What property of chlorine is shown by this colour change?

.....

(1)

(iii) State the colour of red litmus paper in sodium hydroxide solution.

.....

(1)

(iv) What property of sodium hydroxide is shown by this colour change?

.....

(1)

Q1

(Total 8 marks)

Leave blank

2. The formulae CH_4 and C_4H_{10} represent two organic compounds.

(a) State why these compounds are described as

(i) saturated .....

.....

(1)

(ii) hydrocarbons .....

.....

(1)

(b) CH_4 and C_4H_{10} are members of the same homologous series. All members of the same homologous series can be represented by a general formula.

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

.....

(1)

(ii) To which homologous series do CH_4 and C_4H_{10} belong?

.....

(1)

(iii) Give **two** other features of members of the same homologous series.

1 .....

2 .....

(2)

(c) The compound C_4H_{10} exists as isomers. What is meant by the term **isomers**?

.....

.....

(2)

Q2

(Total 8 marks)

Leave blank

3. The Periodic Table on page 2 may be useful in answering parts of this question.

The symbols of some atoms and ions are shown below.

Al Cl^- Mg Mg^{2+} Na^+ O^{2-}

(a) Which **one** of these is formed by the loss of one electron from an atom?

.....

(1)

(b) Which **one** of these is formed by the gain of two electrons by an atom?

.....

(1)

(c) Which **one** of these has the same electronic configuration as an atom of argon?

.....

(1)

(d) Which **one** of these has an electronic configuration of 2.8.2?

.....

(1)

(e) Which **three** of these have the same electronic configuration?

.....

(1)

Q3

(Total 5 marks)

BLANK PAGE

Leave blank

4. The equation shows the formation of hydrogen chloride.

$$H_2 + Cl_2 \rightarrow 2HCl \qquad \Delta H = -184\ kJ$$

(a) (i) What does the symbol ΔH represent?

.....

(1)

(ii) ΔH is negative for this reaction. What does this indicate?

.....

(1)

(b) Draw a dot and cross diagram to show the bonding in H_2.

(1)

(c) H_2 molecules contain strong bonds. Explain why the boiling point of H_2 is low.

.....

.....

(2)

(d) A student carries out a test to show that a solution of hydrogen chloride contains chloride ions. First she adds dilute nitric acid.

(i) Name the other solution she adds.

.....

(1)

(ii) Describe what she observes.

.....

(1)

(iii) Complete the equation to show the reaction that occurs.

..... + HCl → ..... + ...

(2) **Q4**

(Total 9 marks)

TOTAL FOR SECTION A: 30 MARKS

Leave blank

SECTION B

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

Element	Melting point (°C)	Boiling point (°C)
fluorine	–220	–188
chlorine	–101	–35
bromine	–7	
iodine	+114	+184
astatine		+337

(a) (i) Use the information in the table to predict the physical state of astatine at room temperature.

.....

(1)

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

.....

(1)

(b) All atoms of elements in Group 7 have seven electrons in their outer shell. When they react they can form ions.

(i) What is the charge on the ions formed?

.....

(1)

(ii) Explain why the atoms form ions with this charge.

.....

.....

(2)

(c) Which element in Group 7 is the **most** reactive?

.....

(1)

Leave blank

(d) When chlorine gas is bubbled through potassium bromide solution a reaction takes place.

(i) Write the chemical equation for the reaction.

.....

(2)

(ii) What is **seen** during the reaction?

.....

(1)

(e) A compound contains 16.4% potassium, 30.0% chlorine and 53.6% iodine by mass. Calculate the empirical formula of the compound.

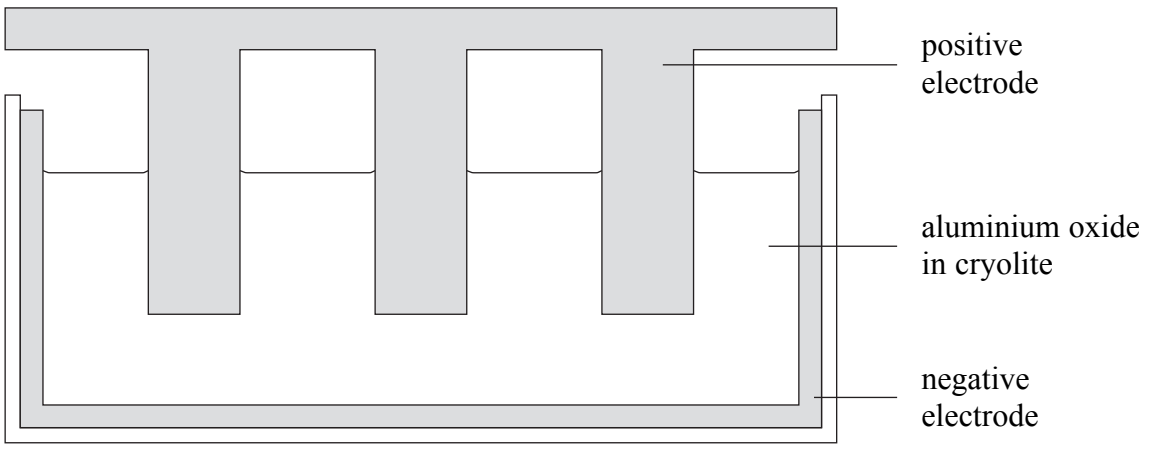
(3)

(Total 12 marks)

Q5

Leave blank

6. Aluminium is extracted from aluminium oxide by electrolysis.
The diagram shows a cross-section through an electrolysis cell.



(a) Aluminium oxide has a melting point of over 2000 °C.

(i) Explain why obtaining molten aluminium oxide is difficult.

.....

.....

(1)

(ii) How does the use of cryolite help to overcome this difficulty?

.....

.....

(2)

(b) The products of the electrolysis are oxygen and aluminium.

The ionic half-equation to show the formation of oxygen at the positive electrode is

$$2O^{2-} \rightarrow O_2 + 4e^-$$

Write the ionic half-equation to show the formation of aluminium at the negative electrode.

.....

(2)

Leave blank

(c) The electrolysis of aluminium oxide is a redox process. Use the equations in (b) to help you identify what has been oxidised. Explain your answer.

Oxidised .....

Explanation .....

(2)

(d) Explain why the positive electrodes need to be replaced regularly.

.....

.....

.....

.....

(3)

Q6

(Total 10 marks)

Leave blank

7. Potassium carbonate, K_2CO_3, reacts with sulphuric acid, H_2SO_4.

$$K_2CO_3(s) + H_2SO_4(aq) \rightarrow K_2SO_4(aq) + H_2O(l) + CO_2(g)$$

Dilute sulphuric acid is placed in a beaker. Solid potassium carbonate is added until no further reaction occurs.

(a) How can you tell that the reaction has stopped?

.....

.....

(1)

(b) (i) Calculate the relative formula mass, M_r, of potassium carbonate.

(1)

(ii) Calculate the amount, in moles, of potassium carbonate in 2.76 g.

(1)

(iii) Calculate the relative formula mass, M_r, of carbon dioxide.

(1)

(iv) Calculate the mass of carbon dioxide formed.

(1)

(v) Calculate the volume of this mass of carbon dioxide at room temperature and pressure (rtp).
The volume of one mole of any gas at rtp is 24 dm^3.

(1)

Leave blank

(c) Describe simple tests that can be used to show that the solution produced in the reaction contains

(i) potassium ions

Test .....

Result .....

(2)

(ii) sulphate ions

Test .....

.....

Result .....

(3)

Q7

(Total 11 marks)

Leave blank

8. Crude oil is a complex mixture of different hydrocarbons. It is separated into useful fractions by fractional distillation. Short-chain hydrocarbons are used as fuels.

(a) Name the fraction that contains methane.

.....

(1)

(b) Long-chain hydrocarbons are cracked to produce hydrocarbons with shorter chains.

(i) State **one** condition needed for cracking to occur.

.....

(1)

(ii) Why are long-chain hydrocarbons available for cracking?

.....

.....

(1)

(c) Methane is used as a fuel. The combustion of methane is shown by the equation

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

In this reaction the energy used to break bonds is less than the energy given out when new bonds are formed. What does this indicate about the reaction?

.....

(1)

(d) When a hydrocarbon burns in a limited supply of oxygen, incomplete combustion occurs. One of the products is carbon monoxide.

(i) Write a chemical equation for the incomplete combustion of methane.

.....

(2)

(ii) Why can incomplete combustion be dangerous?

.....

.....

.....

(2)

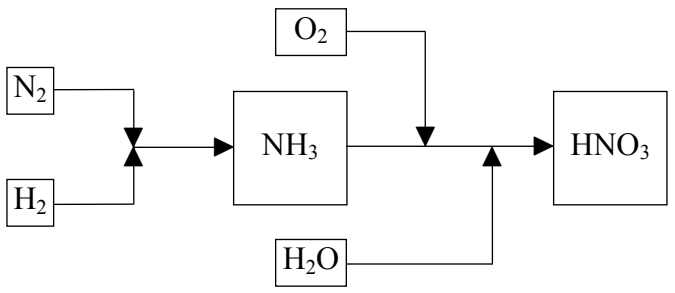
Q8

(Total 8 marks)

TURN OVER FOR QUESTION 9

Leave blank

9. The flow chart shows the steps in the industrial production of ammonia, NH_3, and nitric acid, HNO_3.



(a) (i) Name the raw material from which hydrogen is obtained.

.....

(1)

(ii) Write a chemical equation to show how hydrogen is obtained from this raw material.

.....

(2)

(iii) Name the catalyst used in the production of ammonia.

.....

(1)

(b) During the conversion of ammonia into nitric acid, nitrogen dioxide, NO_2, is made. Nitrogen dioxide can undergo the following reaction.

$$2NO_2(g) \rightleftharpoons N_2O_4(g) \quad \Delta H = -57 \text{ kJ/mol}$$

This reaction is reversible. A dynamic equilibrium is established.

(i) What is meant by the term **dynamic equilibrium**?

.....

.....

.....

(2)

(ii) What happens to the amount of $N_2O_4(g)$ in the mixture at equilibrium when the pressure is increased?

.....

(1)

Leave blank

(iii) What happens to the amount of $N_2O_4(g)$ in the mixture at equilibrium when the temperature is increased?

.....

(1)

(c) (i) Why is it important that oxides of nitrogen are not allowed to escape into the atmosphere?

.....

(1)

(ii) Describe **two** problems that can result.

1 .....

.....

2 .....

.....

(2)

(Total 11 marks)

Q9

Leave blank

10. Diamond and graphite are allotropes of carbon. They both have giant molecular covalent structures.
Both diamond and graphite have high sublimation points.
Diamond can be used for cutting.
Graphite can be used as a lubricant.

(a) Describe, without drawing a diagram, the structure of diamond.
Include the number of atoms to which each carbon atom is bonded and how the atoms are arranged. Explain how this structure relates to the use of diamond in cutting.

.....

.....

.....

.....

.....

.....

(3)

(b) Describe, without drawing a diagram, the structure of graphite.
Include the number of atoms to which each carbon atom is bonded and how the atoms are arranged. Explain how this structure relates to the use of graphite as a lubricant.

.....

.....

.....

.....

.....

.....

(3)

(c) Explain why both diamond and graphite have high sublimation points.

.....

.....

(2) **Q10**

(Total 8 marks)

TOTAL FOR SECTION B: 60 MARKS

TOTAL FOR PAPER: 90 MARKS

END

BLANK PAGE

BLANK PAGE