Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						4	4	3	7	/	5	H	Signature	

Paper Reference(s)

4437/5H

Examiner's use only

Team Leader's use only

London Examinations IGCSE

Science (Double Award)

Chemistry

Paper 5H

Higher Tier

Tuesday 10 November 2009 – Afternoon

Time: 1 hour 30 minutes

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
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. Write your answers in the spaces provided in this question paper.
Show all stages in any calculations and state the units. Calculators may be used.
Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (~~☒~~) and then mark your new answer with a cross (☒).

Information for Candidates

The total mark for this paper is 90. The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 9 questions in this question paper.
There are 20 pages in this question paper. Any 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.
N34949A
W850/U4437/57570 5/7/6/3/

N 3 4 9 4 9 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 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

Leave blank

SECTION A

1. (a) Complete the table of information about the three types of particle found in an atom.

Name of particle	Relative mass	Relative charge
electron		–1
neutron	1	
proton		

(4)

(b) An atom of chlorine can be represented by the symbol

$$^{35}_{17}\mathrm{Cl}$$

(i) Explain the meaning of the term **mass number**. State the mass number of this chlorine atom.

.....

.....

.....

.....

(2)

(ii) How many neutrons are in this atom of chlorine?

.....

(1)

(c) There are two types of boron atoms. Some contain 5 protons and 5 neutrons while others contain 6 neutrons.

(i) How many protons do the second type of boron atoms contain?

.....

(1)

(ii) What name is given to atoms of the same element with different numbers of neutrons?

.....

(1) **Q1**

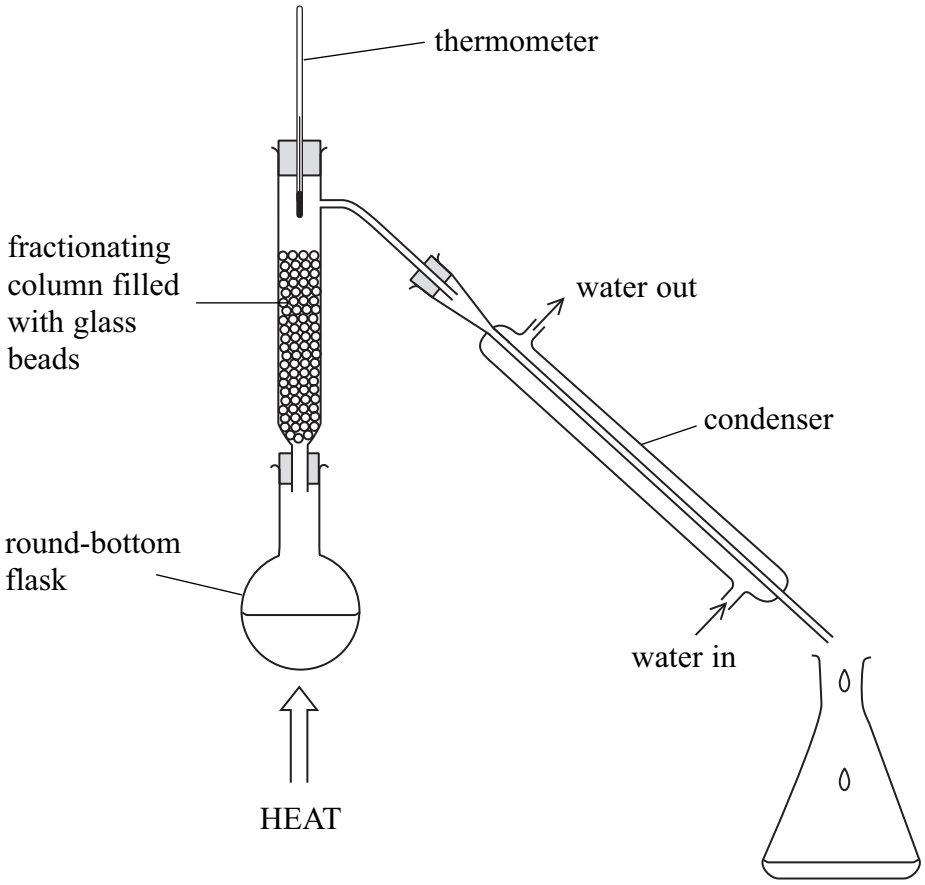
(Total 9 marks)

Leave blank

2. Propanone and water are both covalently bonded compounds. The table shows their boiling points.

Compound	Boiling point (°C)
propanone	56
water	100

(a) Propanone can be obtained from a mixture of propanone and water using the apparatus shown.



(i) Why can propanone and water be separated by this method?

.....

(1)

(ii) Outline how a sample of pure propanone can be obtained from the mixture.

.....

.....

.....

.....

.....

(3)

Leave blank

(b) Propanone and water both have simple molecular structures. They have low boiling points. Place a cross (☒) in **one** box from **each** column of statements to explain why they have low boiling points.

the covalent bonds between their atoms are strong	☒		these require a lot of energy to be overcome	☒
the covalent bonds between their atoms are weak	☒	**AND**	these require little energy to be overcome	☒
the attractive forces between their molecules are strong	☒		these get weaker as the temperature increases	☒
the attractive forces between their molecules are weak	☒			

(2) Q2

(Total 6 marks)

Leave blank

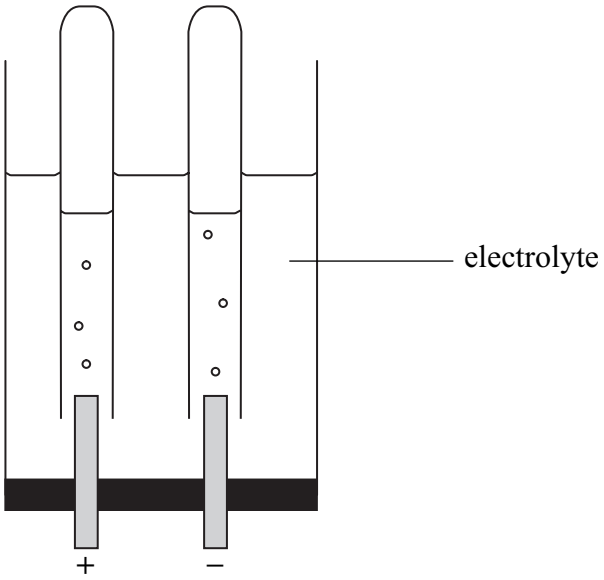
3. This question is about chlorine and other elements in Group 7 of the Periodic Table.

(a) Complete the table to show the colours and states of some elements in Group 7.

Name of element	Colour	State at room temperature
chlorine	green	gas
bromine	brown	
iodine		solid

(2)

(b) The diagram shows the electrolysis of an aqueous solution of a compound.
The electrolysis produces chlorine and another gas.



(i) Add a label to the diagram to show the chlorine gas.

(1)

(ii) Identify the other gas produced during the electrolysis.

.....

(1)

(iii) What is the electrolyte used in the industrial production of chlorine?

.....

(1)

Leave blank

(c) When chlorine gas is bubbled into colourless sodium bromide solution a reaction takes place. The solution becomes brown.

Write a word equation for the reaction which takes place.

.....

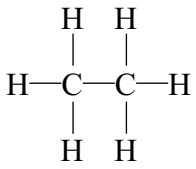
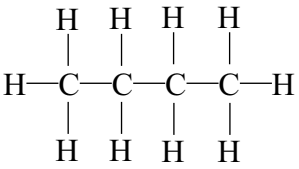
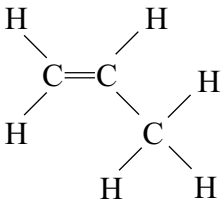
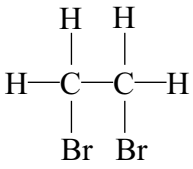
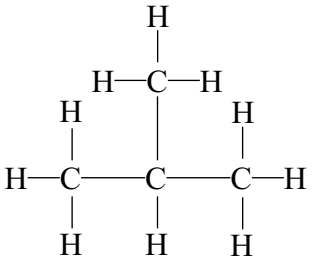
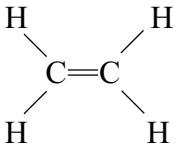
(2)

Q3

(Total 7 marks)

Leave blank

4. The table shows the structures of some organic compounds.

 **A**	 **B**
 **C**	 **D**
 **E**	 **F**

(a) Explain why compound **C** is not a saturated hydrocarbon.

.....

.....

(1)

(b) Explain why compound **D** is not a hydrocarbon.

.....

.....

(1)

(c) Give the letters of two compounds that are isomers of each other.

.....

(1)

Leave blank

(d) Give the letters of two compounds that are members of the same homologous series but have different molecular formulae.

.....

(1)

(e) Name and give the general formula of the homologous series to which compound **E** belongs.

Name of homologous series .....

General formula .....

(2)

(f) What colour change is seen when bromine water is added to compound **F**?

.....

.....

(2) **Q4**

(Total 8 marks)

TOTAL FOR SECTION A: 30 MARKS

Leave blank

SECTION B

5. Lithium and sodium are metals in Group 1 of the Periodic Table. They react in a similar way with water, producing hydrogen gas and an alkaline solution.

(a) A student added a piece of lithium to a trough of water. A piece of platinum wire is dipped into the solution formed and then held in a hot Bunsen flame.

(i) What colour does the flame become?

.....

(1)

(ii) What is the formula of the ion responsible for this colour?

.....

(1)

(b) State the colour of methyl orange in the alkaline solution formed in (a) and give the formula of the ion which causes the solution to be alkaline.

Colour of methyl orange .....

Formula of ion .....

(2)

(c) A piece of sodium is added to another trough of water.

(i) Give two observations, other than the sodium floating, that you could make during the reaction.

1 .....

2 .....

(2)

(ii) Write a chemical equation for the reaction.

.....

.....

(2)

Leave blank

(d) Rubidium is another Group 1 metal. A piece of rubidium is added to a different trough of water.

(i) Predict one observation that would be different using rubidium instead of sodium.

.....

.....

(1)

(ii) Predict a possible pH value for the solution formed in the reaction between rubidium and water.

.....

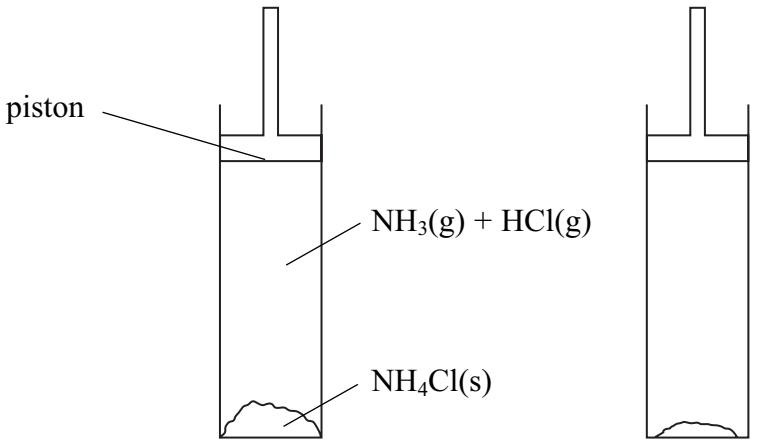
(1)

Q5

(Total 10 marks)

Leave blank

6. A sample of solid ammonium chloride is placed in a tube fitted with a piston.
The tube is heated in an oven to a constant temperature.
The diagram shows the apparatus used.



(a) The reaction inside the tube can be represented by the equation:

$$NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$$

The value of ΔH for the forward reaction is positive.

(i) State the name of:

$NH_3(g)$ .....

$HCl(g)$ .....

(2)

(ii) What does the $\rightleftharpoons$ symbol indicate about the reaction?

.....

(1)

(iii) What does the positive value of ΔH indicate about the forward reaction?

.....

(1)

(b) Describe the appearance of:

$NH_4Cl(s)$ .....

the mixture of $NH_3(g)$ and $HCl(g)$ .....

(2)

Leave blank

(c) After leaving the tube in the oven at a constant temperature a dynamic equilibrium is established inside the tube.
Explain what is meant by the term **dynamic equilibrium**.

.....

.....

.....

.....

(2)

(d) The temperature of the oven is increased by 30 °C and the tube is left at this temperature until a new dynamic equilibrium is established inside the tube. Predict what effect, if any, this temperature increase has on:

the speed of the forward reaction .....

the speed of the reverse reaction .....

the amount of $NH_4Cl(s)$ at equilibrium .....

(3)

(e) The piston is pushed about halfway down the tube, without altering the temperature. This causes the concentrations of the gases inside the tube to increase.
State and explain, in terms of the particle collision theory, how this change affects the rate of the reaction between $NH_3(g)$ and $HCl(g)$.

.....

.....

.....

.....

.....

.....

(3)

Q6

(Total 14 marks)

Leave blank

7. Iron is extracted from iron ore in a blast furnace using three raw materials, **J**, **K** and **L**.

J is a black solid, **K** is a white solid composed mostly of calcium carbonate, and **L** is a colourless mixture of gases.

(a) Give the names of these raw materials.

J .....

K .....

L .....

(3)

(b) The chemical equations for three reactions that occur in the blast furnace are:

I $C + O_2 \rightarrow CO_2$

II $C + CO_2 \rightarrow 2CO$

III $CaCO_3 \rightarrow CaO + CO_2$

(i) Explain why reaction **I** is important in the blast furnace.

.....

(1)

(ii) State the function of the product of reaction **II**.

.....

(1)

(iii) The function of the CaO formed in reaction **III** is to remove impurities in the iron ore. Write a chemical equation to show the reaction that occurs.

.....

(2)

(c) Two molten substances, **M** and iron, collect at the bottom of the blast furnace.

Give the name of **M** and suggest why it floats on top of the molten iron.

.....

.....

.....

(2)

Leave blank

(d) Iron has many uses.

Suggest one property of iron, different in each case, that makes it suitable for:

making railway lines .....

.....

using in the Haber process .....

.....

(2)

(e) One problem with using iron to make objects is rusting.
Galvanising is a method of preventing rusting that involves coating iron with zinc.

(i) Give the chemical name of rust.

.....

(1)

(ii) Explain how zinc is able to prevent iron from rusting even when the coating is scratched.

.....

.....

.....

.....

(2)

Q7

(Total 14 marks)

Leave blank

8. (a) An oxide of copper contains 88.8% by mass of copper.
Calculate the empirical formula of this oxide.

(3)

(b) The following sequence shows two reactions of copper(II) compounds.

$$\underset{\textbf{P}}{CuCl_2(aq)} \xrightarrow{NaOH(aq)} \underset{\textbf{Q}}{Cu(OH)_2(s)} \xrightarrow{NH_3(aq)} \underset{\textbf{R}}{[Cu(H_2O)_2(NH_3)_4]^{2+}(aq)}$$

(i) State the colour of **Q**.

.....

(1)

(ii) State two observations you would make when **Q** is converted into **R**.

1 .....

2 .....

(2)

(iii) What type of cation is **R**?

.....

(1)

Leave blank

(c) A solution contains NH_4^+, Cu^{2+} and SO_4^{2-} ions.

(i) Describe how you could test for the presence of NH_4^+ ions in this solution. Give the result of this test.

.....

.....

.....

.....

(4)

(ii) Describe a test, and its result, to show that the solution contains SO_4^{2-} ions.

.....

.....

.....

(3)

Q8

(Total 14 marks)

Leave blank

9. A student wanted to make some crystals of sodium nitrate.

She did a titration to find the volumes of sodium hydroxide solution and dilute nitric acid needed to react together completely.
She placed a 25.0 cm^3 sample of the nitric acid solution in a conical flask and titrated it with sodium hydroxide solution, using phenolphthalein as an indicator. The phenolphthalein changed colour after she added a total of 20.00 cm^3 of the sodium hydroxide solution.

The equation for the reaction is:

$$NaOH(aq) + HNO_3(aq) \rightarrow NaNO_3(aq) + H_2O(l)$$

(a) State the colour change of the phenolphthalein.

.....

.....

(2)

(b) In this titration the amount of sodium hydroxide used was 0.020 mol.

(i) Calculate the relative formula mass of sodium nitrate.

(1)

(ii) Calculate the mass of sodium nitrate formed in the titration.

(2)

Leave blank

(c) A solution of sodium nitrate was formed by neutralising some dilute nitric acid with aqueous sodium hydroxide.

Outline how you could obtain a dry sample of sodium nitrate crystals from the solution formed.

.....

.....

.....

.....

.....

.....

.....

.....

(3) **Q9**

(Total 8 marks)

TOTAL FOR SECTION B: 60 MARKS

TOTAL FOR PAPER: 90 MARKS

END

BLANK PAGE