Paper Reference(s)

4437/5H

London Examinations IGCSE

Science (Double Award)

Paper 5H

Higher Tier

Specimen Paper

Time: 1 hour 30 minutes

Materials required for examination	**Items included with question papers**
Nil	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

There are 15 pages in this question paper. All blank pages are indicated.

The total mark for this paper is 90. The marks for the various parts of questions are shown in round brackets: e.g. (**2**).

Advice to Candidates

You are reminded of the importance of clear English and careful presentation in your answers.

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Specimen

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THE PERIODIC TABLE

Period	Group 1	Group 2														Group 3	Group 4	Group 5	Group 6	Group 7	Group 0
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

84

Specimen Papers and Mark Schemes – London Examinations IGCSE in Science (Double Award) (4437)
Publication code: UG014359 Issue 1, July 2004

1. (a) Name the starting materials used in the manufacture of ammonia.

....   and   ....

(1)

(b) The industrial process for the manufacture of ammonia uses a catalyst of iron.

   (i) What is a catalyst?

....

....

(2)

   (ii) Why does the same mass of a catalyst work better when it is in the form of thin wires rather than in large lumps?

....

....

(1)

(c) An NPK fertiliser is a mixture of chemicals containing elements represented by the symbols N, P and K.

Complete the following table.

Symbol	Name of element	Formula of a compound containing this element
N	Nitrogen	NH_4NO_3
P		P_2O_5
K	Potassium	

(2)

(d) The chemical formula NH_4NO_3 represents the compound ammonium nitrate.

   (i) How many atoms of nitrogen are shown in the formula for ammonium nitrate?

....

(1)

   (ii) What is the relative formula mass of ammonium nitrate?

....

(1)   **Q1**

(Total 8 marks)

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Specimen Papers and Mark Schemes – London Examinations IGCSE in Science (Double Award) (4437)
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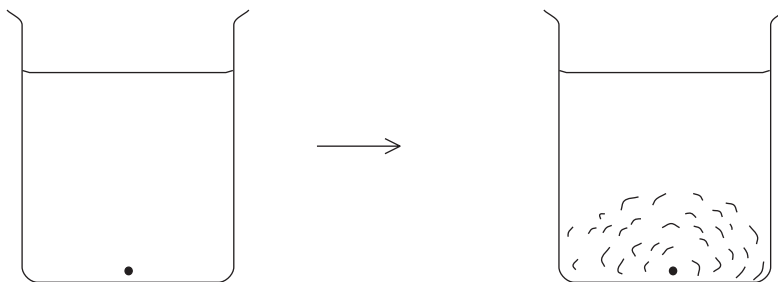**2.** In an experiment a small crystal of potassium manganate(VII) (potassium permanganate) was placed at the bottom of a beaker of cold water. After a short time the colour of the crystal began to spread through the water.

(a) Name the process by which the potassium and manganate(VII) ions move through the water.

....

(1)

(b) In what way would the outcome of the experiment be different, if at all, if warm water was used in place of cold water?

....

....

(1)

(c) Explain your answer to part (b) in terms of movement of particles.

....

....

....

(2)

(d) The dot (•) below represents a single manganate(VII) ion. Draw lines from it to show the typical movement of the ion in water.

•

(2)   **Q2**

(Total 6 marks)

3. (a) Draw a dot-and-cross diagram (representing outer electrons only) to show the type of bonding present in methane (CH_4).

(1)

(b) When methane is burnt in a good supply of air it produces only water and carbon dioxide.

   (i) Write a word equation for this reaction.

     ....

(1)

   (ii) Under what conditions would carbon monoxide gas also be produced?

     ....

(1)

   (iii) Why is it dangerous for methane gas to produce carbon monoxide?

     ....

     ....

(1)

Q3

(Total 4 marks)

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4. (a) The diagram shows the arrangement of particles in an atom of the element lithium.
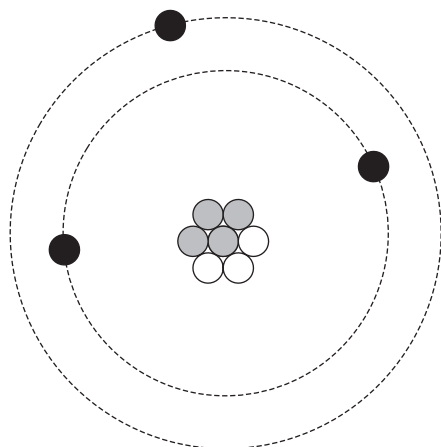
Key
- ● Particle **A**
- ◐ Particle **B**
- ○ Particle **C**

(i) Identify the particles **A**, **B** and **C**.

Particle **A** ....

Particle **B** ....

Particle **C** ....

(3)

(ii) What is the mass number of the atom in the diagram?

....

(1)

(iii) Use the diagram to explain why this element is in group 1 of the periodic table.

....

....

(1)

(b) Sodium chloride solution is used to manufacture chlorine, hydrogen and sodium hydroxide.

   (i) This manufacturing process uses

   A combustion
   B cracking
   C electrolysis
   D neutralisation

   Write the correct answer (**A**, **B**, **C** or **D**) in the box.

   (1)

   (ii) Which product is used in water purification?

   A chlorine
   B hydrogen
   C sodium hydroxide

   Write the correct answer (**A**, **B** or **C**) in the box.

   (1)

(c) The table shows the number of protons, neutrons and electrons in a chlorine atom.

   (i) Complete the table to show the number of these particles in the chloride ion, Cl^-, formed from this atom.

	Chlorine atom (Cl)	Chloride ion (Cl^-)
Number of protons	17	....
Number of neutrons	18	....
Number of electrons	17	....

   (3)

   (ii) What is the arrangement of electrons in a chlorine **atom**?

   ....

   (1)

   (iii) What is the arrangement of electrons in a chloride ion?

   ....

   (1)

   Q4

   (Total 12 marks)

Turn over

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5. The table below gives information about the main fractions obtained from crude oil.

Fraction	Boiling range in °C	Number of carbon atoms in each molecule
Gas	–40 to 40	1 to 4
Petrol	40 to 100	4 to 8
Naphtha	100 to 160	6 to 10
Kerosene	160 to 250	10 to 16
Diesel oil	250 to 300	16 to 20
Fuel oil	300 to 350	20 to 25

(a) State and explain the pattern shown between the boiling range of the fractions and the number of carbon atoms in each molecule.

....

....

....

....

(2)

(b) Fuel oil is cracked to form more useful products such as petrol and naphtha. Cracking produces a mixture of saturated and unsaturated hydrocarbons.

(i) Describe how cracking is carried out.

....

....

....

....

(2)

(ii) Describe a test for an unsaturated hydrocarbon.

....

....

....

....

(2)

(c) Propene (C_3H_6) can be obtained by cracking alkanes.

   (i) Draw the structure of a molecule of propene showing **all** the bonds.

(2)

   (ii) One molecule of the alkane decane ($C_{10}H_{22}$) was cracked to give two molecules of propene and one molecule of an alkane.

   Write the balanced equation for this reaction.

   ....

(2)

(d) Propene is used to make poly(propene).

   (i) What feature of a propene molecule enables it to form poly(propene)?

   ....

(1)

   (ii) Draw the structure of the repeating unit in poly(propene).

(2)

   (iii) Poly(ethene) is used to make many types of bottle.

   Suggest why the more expensive poly(propene) is used to make bottles for fizzy drinks.

   ....

   ....

(1)

Q5

(Total 14 marks)

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6. The table gives information about three chlorides.

Name	Formula
aluminium chloride	$AlCl_3$
calcium chloride	$CaCl_2$
copper chloride	$CuCl_2$

(a) Only one of the chloride solutions is coloured.

   (i) Which chloride solution is coloured?

....

(1)

   (ii) Use the periodic table to explain why you would expect this chloride solution to be coloured.

....

(1)

(b) Magnesium reacts with two of the chloride solutions in the table to precipitate a metal. One reaction is with copper chloride solution. The equation for this reaction is

$$Mg(s) + CuCl_2(aq) \longrightarrow MgCl_2(aq) + Cu(s)$$
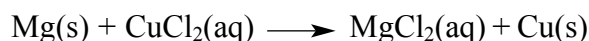
   (i) Name the other chloride solution which reacts to precipitate a metal. Write a balanced equation, including state symbols, for its reaction with magnesium.

Name ....

Equation ....

....

(4)

   (ii) Explain why magnesium is said to be oxidised when it reacts with these two chloride solutions.

....

....

(1)

   (iii) Explain why magnesium does not react with the other chloride solution in the table.

....

....

(2)

(Total 9 marks)

Q6

7. The concentration of a solution of sodium hydroxide was found by titrating the solution with 0.200 mol dm^{-3} sulphuric acid.

25.0 cm^3 of the sodium hydroxide solution required 31.5 cm^3 of the sulphuric acid for complete reaction.

(a) (i) Explain why Universal indicator is **not** a suitable indicator for use in titrations.

....

....

(1)

(ii) Name a suitable indicator for this titration.

....

(1)

(iii) State the colour of the indicator in (a)(ii).

at the start of the titration ....

at the end of the titration ....

(2)

(b) Write an equation, including state symbols, for the reaction that occurs during the titration.

....

(3)

(c) Sodium hydroxide solution is used to test for copper(II) ions in solution.

(i) Describe what you would **see** in this test.

....

(1)

(ii) Write the ionic equation for this reaction.

....

(2)

(Total 10 marks)

Q7

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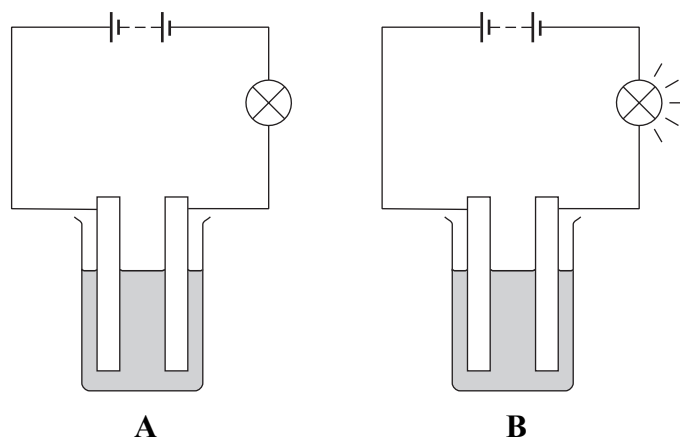Publication code: UG014359 Issue 1, July 2004

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8. The following diagrams show what happens when an electric current was passed through lead bromide ($PbBr_2$). In diagram **A** the lead bromide is solid while in diagram **B** it is molten.

(a) (i) What difference do you observe between diagrams **A** and **B**?

....

(1)

(ii) Which of the following is the best explanation for your observation? Draw a ring around the letter of your answer.

A Lead bromide only contains ions when it is molten

B Solid lead bromide is a covalent compound

C When lead bromide is molten the ions can move about

D Metals like lead are good conductors of electricity

(1)

(b) What is the name of the process that occurs in diagram **B**?

....

(1)

(c) Complete the table showing what happens at the electrodes in diagram **B**.

Electrode	Name of product	Equation for reaction
positive	Lead	$Pb^{2+} +$ .... $\rightarrow Pb$
negative	....	$2Br^- - 2e^- \rightarrow Br_2$

(2)

Q8

(Total 5 marks)

9. (a) Phosphorus reacts with chlorine to form phosphorus trichloride, PCl_3.
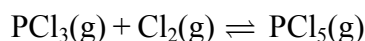The equation for the reaction is

$$2P + 3Cl_2 \rightarrow 2PCl_3$$
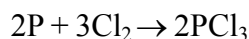
Calculate the maximum mass of phosphorus trichloride that can be made from 0.93 g of phosphorus.
(Relative atomic masses: P = 31; Cl = 35.5)

....

....

....

....

(3)

(b) Phosphorus forms two chlorides which can exist as gases in equilibrium.

$$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$$

The formation of phosphorus pentachloride (PCl_5) in this way is exothermic.

State, with a reason, the effect on the amount of phosphorus pentachloride present at equilibrium if

(i) the temperature is increased

effect ....

reason ....

(2)

(ii) the pressure is increased ....

effect ....

reason ....

(2)

(c) Carbon can form a chloride.
0.36 g of carbon is present in 4.62 g of carbon chloride.
Calculate the empirical formula of this chloride.

(Relative atomic masses: C = 12; Cl = 35.5)

....

....

....

....

(4)
(Total 11 marks)

Leave blank

Q9

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10. The element bromine exists as a mixture of two isotopes.

(a) (i) Complete the table to show the number of protons and neutrons in the nuclei of the two isotopes of bromine.

Atomic number of isotope	Mass number of isotope	Number of protons	Number of neutrons
35	79	....	....
35	81	....	....

(2)

(ii) The relative atomic mass of bromine is 80.
Deduce the percentage abundance of the two isotopes in bromine.

....

....

(1)

(b) Bromine is extracted by blowing chlorine gas through sea water which contains bromide ions.
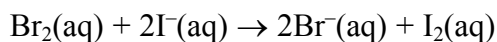
(i) Write an ionic equation for this reaction.

....

(2)

(ii) Explain why iodine could **not** be used instead of chlorine in this process.

....

....

(1)

(c) Bromine is reduced when it reacts with iodide ions.

$$Br_2(aq) + 2I^-(aq) \rightarrow 2Br^-(aq) + I_2(aq)$$

(i) Name one compound containing I^- ions, which would be suitable for this reaction.

....

(1)

(ii) State **one** change you would **see** as this reaction takes place.

....

(1)

(iii) Explain why bromine is said to be reduced in this reaction.

....

....

(1)

(iv) Complete the half equation to show the iodide ions being oxidised.

..................$I^- \rightarrow I_2 +$ ....

Q10

(2)
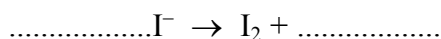
(Total 11 marks)

TOTAL FOR PAPER: 90 MARKS

END