1522/5H 1530/3H

Edexcel GCSE

Science: Double Award A [1522]

Paper 5H

Chemistry A [1530]

Paper 3H

Higher Tier

Wednesday 13 June 2007 – Morning

Time: 1 hour 30 minutes

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

Instructions to Candidates

In the boxes above, write your centre number, candidate number, the paper reference, your surname, initial(s) and signature.

The paper reference is shown above. If more than one paper reference is shown, you should write the one for which you have been entered.

Answer **ALL** questions in the spaces provided in this book.

Show all stages in any calculations and state the units. Calculators may be used.

Include diagrams in your answers where these are helpful.

Information for Candidates

The marks for the various parts of questions are shown in round brackets: e.g. **(2)**.

This paper has eight questions. There are no blank pages.

Advice to Candidates

This symbol shows where the quality of your written answer will also be assessed.

Turn over

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THE PERIODIC TABLE

Group

Period	1	2												3	4	5	6	7	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	85 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	178 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

1. Sodium chloride is found in sea water and in rocks.

(a) Electrolysis of concentrated sodium chloride solution produces two gases and an alkaline solution.

(i) Name the green gas produced at the positively charged electrode.

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(1)

(ii) Name the colourless gas produced.

....
(1)

(iii) Name the alkaline solution formed.

....
(1)

(b) Bromine compounds are often found in sea water.

Bromine has two different atoms, **A** and **B**. The numbers of electrons, neutrons and protons in each of these atoms are shown in the table.

	electrons	neutrons	protons
A	35	44	35
B	35	46	35

(i) What evidence is there in the table that **A** and **B** are both atoms of bromine?

....

....
(1)

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

....
(1)

(c) Sodium reacts with bromine to form sodium bromide (NaBr).

(i) Write a balanced equation for this reaction, including state symbols.

....

(3)

(ii) The diagram shows the electrons in the outer shells of a sodium atom and a bromine atom.

sodium atom   bromine atom
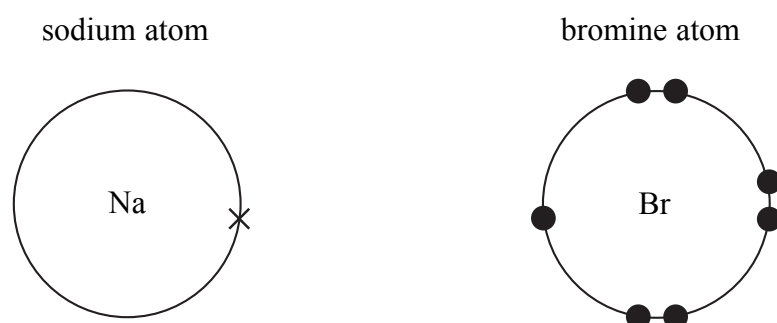
Draw an arrow to show the movement of an electron when a sodium atom reacts with a bromine atom.

(1)

(iii) What name is given to atoms that have gained or lost electrons?

....

(1)

(iv) What type of bond is formed between sodium and bromine in sodium bromide?

....

(1)

(d) Describe how sedimentary rocks may be formed on the sea bed.

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(4)

(Total 15 marks)

TURN OVER FOR QUESTION 2

Q1

Turn over

2. Read the following news item that appeared in June 2004.

Wales is likely to become the first country in the world to mass-produce a new fuel called hithane. Hithane is a mixture of hydrogen and methane. Burning hithane instead of petrol would produce a third less carbon dioxide. Under the Kyoto treaty on reducing greenhouse gases, European governments have agreed to reduce carbon dioxide emissions.

(a) When hydrogen burns, it reacts with oxygen in the air to produce water.

(i) Balance the equation and fill in the missing state symbols.

$$H_2(g) \quad + \quad O_2(\quad) \quad \rightarrow \quad H_2O(\quad)$$

(2)
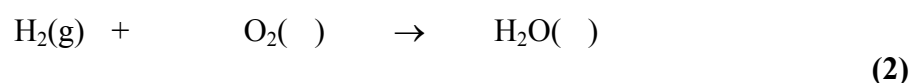
(ii) Give the name of the type of bonding between hydrogen and oxygen atoms in a water molecule.

....

(1)

(iii) Draw a dot and cross diagram of a water molecule, showing only the outer electrons.

(2)

(b) Methane, CH_4, is a hydrocarbon.

(i) What is meant by the term **hydrocarbon**?

....

....

(2)

(ii) Name a natural source of methane.

....

(1)

(c) Incomplete combustion of petrol or methane produces carbon monoxide.

Explain the dangers of carbon monoxide in enclosed spaces.

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(3)

(d) Suggest why the use of hithane instead of petrol would reduce carbon dioxide emissions.

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(2)   **Q2**

(Total 13 marks)

TURN OVER FOR QUESTION 3

3. When a piece of heated potassium is put into a gas jar of chlorine, potassium chloride is formed.

(a) Complete the table to show the relative mass, relative charge and position in an atom of an electron, a neutron and a proton.

particle	relative mass	relative charge	position in the atom
electron	negligible	−1	orbiting the nucleus
neutron	…………..	0	in the nucleus
proton	1	……….	………………………

(3)

(b) A potassium atom has an atomic number of 19 and a mass number of 39.

Write down the number of each type of particle in this atom of potassium.

number of electrons ....

number of neutrons ....

number of protons ....

(3)

(c) Give the electronic structure for an atom of potassium.

....

(2)

(d) Chlorine has seven electrons in its outer shell.

What information does this give about its position in the periodic table?

....

....

(1)

(e) Describe what you would **see** when potassium chloride is added to water and stirred.

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(2)

(f) Bromine is below chlorine in the halogen group.

Describe how the electronic structures of chlorine and bromine atoms are similar.

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(2) **Q3**

(Total 13 marks)

TURN OVER FOR QUESTION 4

4. Sea water contains dissolved sodium bromide.

(a) Bromine is extracted by bubbling chlorine gas through sea water.

(i) Explain why chlorine is used.

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(2)

(ii) Write the balanced equation for the reaction between chlorine and sodium bromide solution.

....

(3)

(b) Describe how bromine water is used to distinguish between saturated and unsaturated hydrocarbons.

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(3)

(c) Bromine can be converted into hydrogen bromide solution.

(i) Suggest a pH value for hydrogen bromide solution.

....

(1)

(ii) Explain your answer.

....

(1)

(Total 10 marks)

Q4

5. Caesium is a soft, metallic element in group 1 of the periodic table. It ignites spontaneously in air and reacts explosively with cold water, setting fire to the liberated hydrogen. Caesium is even capable of reacting with ice at temperatures above −116 °C. The product formed is a strong alkali and can attack glass. The melting point of caesium is 29 °C.

(a) (i) Name the alkali formed when caesium reacts with water.

....

(1)

(ii) Write the balanced equation for the reaction between caesium and water.

....

(3)

(iii) Describe the differences and similarities between the reaction of caesium and the reactions of the other elements in group 1 with water.

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(2)

(b) The forces holding the atoms together in solid caesium are relatively weak.

Give **two** pieces of evidence from the introduction above to support this statement.

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(2) **Q5**

(Total 8 marks)

TURN OVER FOR QUESTION 6

6. Poly(ethene) is a polymer made from the monomer ethene, C_2H_4.

(a) Draw the structural formula of a molecule of ethene, showing all covalent bonds.

(2)

(b) This polymerisation can be carried out at a temperature of about $80\,°C$.

Explain, in terms of particles, why the reaction is faster at $80\,°C$ than it is at room temperature.

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(3)

(c) What is the empirical formula of poly(ethene)?

....

(1)

(d) Part of the structure of a polymer is shown below.

$$\begin{array}{cccccc} Cl & CH_3 & Cl & CH_3 & Cl & CH_3 \\ | & | & | & | & | & | \\ -\;C & -\;C & -\;C & -\;C & -\;C & -\;C\;- \\ | & | & | & | & | & | \\ H & H & H & H & H & H \end{array}$$
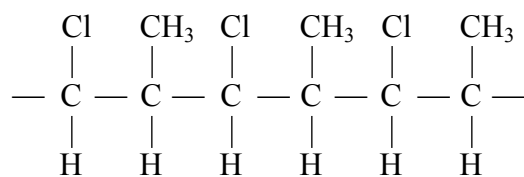
In the box, draw the structure of the monomer molecule from which this polymer is made.

(2)

(Total 8 marks)

Q6

TURN OVER FOR QUESTION 7

7. Oxygen was released into the early atmosphere when plants evolved. Some of this oxygen formed the gas ozone, O_3. Ozone protects the Earth from ultraviolet radiation (which can cause fatal cancers in animals).

(a) When oxygen forms ozone, an equilibrium is established.

Write the balanced equation for this reaction.

....

(3)

(b) Suggest reasons, using the information above, why the evolution of animals could not have happened until after plants evolved.

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(3)

(c) When magnesium reacts with oxygen, it forms magnesium oxide. This reaction involves both oxidation and reduction.
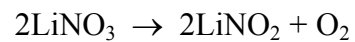
Explain this in terms of electrons.

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....

(3)

(d) Oxygen is formed when lithium nitrate is heated.

Calculate the mass of oxygen that is formed by the complete decomposition of 10 g of lithium nitrate.

$$2LiNO_3 \rightarrow 2LiNO_2 + O_2$$

(Relative atomic masses: Li = 7.0;   N = 14;   O = 16)

....

....

....

....

....

....

answer = ... g

(3)

Q7

(Total 12 marks)

TURN OVER FOR QUESTION 8

8. Iron is produced by reacting iron oxide with carbon monoxide in a blast furnace.

Aluminium is produced by the electrolysis of molten aluminium oxide.

(a) Iron could be produced by electrolysis.

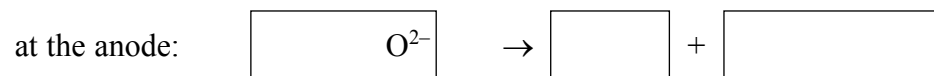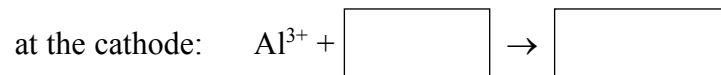Why is iron produced by reduction with carbon monoxide instead of by electrolysis?

....
(1)

(b) Suggest why aluminium cannot be produced by reacting aluminium oxide with carbon monoxide.

....

....

....
(2)

(c) Complete the equations showing the reactions at the electrodes in aluminium extraction.

at the cathode: Al^{3+} + ⬚   →   ⬚

at the anode: ⬚ O^{2-} →   ⬚   +   ⬚
(4)

(d) 100 g of an oxide of iron is found to contain 70 g iron.

Calculate the empirical formula of this oxide.

(Relative atomic masses: O = 16;   Fe = 56)

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....

....

empirical formula ....
(4)   **Q8**

(Total 11 marks)

TOTAL FOR PAPER: 90 MARKS

END