Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	2	4	1	/	0	1	Signature	

Paper Reference(s)

6241/01

Edexcel GCE

Chemistry

Advanced Subsidiary

Unit Test 1

Thursday 17 January 2008 – Morning

Time: 1 hour

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Candidates may use a calculator.

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Answer **ALL** the questions. Write your answers in the spaces provided in this question paper.
Show all the steps in any calculations and state the units.

Information for Candidates

The total mark for this paper is 60. The marks for individual questions and parts of questions are shown in round brackets: e.g. **(2)**. There are 16 pages in this question paper. All blank pages are indicated.
A Periodic Table is printed on the back cover of this question paper.

Advice to Candidates

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

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Answer ALL questions. Write your answers in the spaces provided.

1. (a) Complete the electronic configuration of a copper atom and a bromide ion.

(i) Copper atom, Cu $1s^2 2s^2 2p^6 3s^2 3p^6$.....

(1)

(ii) Bromide ion, Br^- $1s^2 2s^2 2p^6 3s^2 3p^6$.....

(1)

(b) Define the term **relative atomic mass**.

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(2)

(c) The following data were obtained for a mass spectrum of a sample of copper.

Relative isotopic mass	Percentage abundance
62.93	69.17
64.93	30.83

Calculate the relative atomic mass of this sample of copper. Give your answer to two decimal places.

(2)

Leave blank

(d) Copper occurs naturally as the mineral malachite. The composition, by mass, of malachite is as follows:

Cu = 57.5% C = 5.4% O = 36.2% H = 0.9%

(i) Calculate its empirical formula.

(2)

(ii) The molar mass of malachite is 221 g mol^{-1}. Calculate its **formula**.

(1)

(e) Copper forms a chloride, $CuCl_2$. Use the data below to calculate the maximum and the minimum values for the molar mass of $CuCl_2$.

Data : Relative isotopic masses of chlorine are 35 and 37.
Relative isotopic masses of copper are 63 and 65.

(2)

Q1

(Total 11 marks)

Leave blank

2. (a) Lithium chloride, potassium carbonate and sodium iodide can be distinguished using flame tests. Complete the table below.

	Formula	Flame colour
lithium chloride	LiCl	
potassium carbonate	K_2CO_3	
sodium iodide	NaI	

(2)

(b) Explain the origin of the colours in the flame test.

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(2)

(c) Write equations for the following reactions. Do **not** include state symbols.

(i) Lithium chloride and concentrated sulphuric acid.

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(1)

(ii) Potassium carbonate and dilute nitric acid.

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(1)

(iii) Sodium iodide solution and silver nitrate solution.

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(1)

Leave blank

(d) Beryllium chloride, $BeCl_2$, is covalent.

(i) Use ideas of **ion polarisation** or **electronegativity** to suggest why beryllium chloride, a compound of a metal and a non-metal, is covalent rather than ionic.

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(2)

(ii) Draw a 'dot and cross' diagram to show the bonding in a beryllium chloride **molecule**, $BeCl_2$. In your diagram show all the outer shell electrons in the atoms of beryllium and chlorine.

(1)

Q2

(Total 10 marks)

Leave blank

3. In hydrogen fluoride, HF, and water, H_2O, the major intermolecular force is the **hydrogen bond**.

(a) Draw a diagram to show the formation of hydrogen bonds between water molecules in ice. Show at least three water molecules in your diagram and any relevant polarity in the molecules.

(3)

(b) Suggest why water has a higher boiling temperature than hydrogen fluoride.

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(2)

Leave blank

(c) When hydrogen fluoride reacts with water it forms hydrogen ions. A lone pair of electrons on the water molecule joins with the hydrogen ion, H^+, to produce the ion H_3O^+.

(i) Draw a diagram to show clearly the shape of the H_3O^+ ion.

(1)

(ii) Suggest an approximate value for the bond angle H—O—H in H_3O^+.

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(1)

(iii) The oxygen atom in water has two lone pairs of electrons. Suggest why the ion H_4O^{2+} is not generally formed in acid solutions that contain the H^+ ion.

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(1)

Q3

(Total 8 marks)

Leave blank

4. (a) Explain the term **reducing agent** in terms of oxidation number change.

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(1)

(b) Write ionic half-equations (do **not** include state symbols) to show:

(i) chlorate(I) ions, ClO^-, in **acidic** solution, being reduced to chlorine molecules and water.

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(1)

(ii) chloride ions being oxidised to chlorine molecules.

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(1)

(c) Combine the two equations in (b) to show the effect of adding an acid to a mixture of chlorate(I) ions and chloride ions.

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(1)

(d) Describe what you would **see** if concentrated sulphuric acid is added to solid sodium iodide.

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(2)

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(e) Potassium chlorate, $KClO_3$, decomposes on heating to give potassium chloride, KCl, and oxygen, O_2.

(i) Write the equation for this reaction. State symbols are **not** required.

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(1)

(ii) Show, by the use of **oxidation numbers**, why this is a redox reaction.

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(3)

Q4

(Total 10 marks)

Leave blank

5. (a) Cooking fuels and petrol for car engines need to be gases or liquids which vaporise easily. This will be the case if the intermolecular forces are weak.

Two common fuels are methane, CH_4, and 2,2,4-trimethylpentane, C_8H_{18}.

	Electronegativity
carbon	2.1
hydrogen	2.5

(i) Explain the meaning of the term **electronegativity**.

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(2)

(ii) The C—H bond in methane has some polarity but overall the molecule is non-polar.

Explain why methane is a non-polar molecule.

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(2)

(iii) Identify the strongest **intermolecular** force that exists between 2,2,4-trimethylpentane molecules in the liquid state.

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(1)

Leave blank

(b) In a car engine 2,2,4-trimethylpentane burns in air to produce carbon dioxide and water.

The equation is

$$2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$$

Molar mass of $C_8H_{18} = 114\ g\ mol^{-1}$

(i) Calculate the volume of oxygen needed to burn 700 g of 2,2,4-trimethylpentane. [Assume the molar volume of a gas = 24.0 $dm^3\ mol^{-1}$]

(3)

(ii) Calculate the mass of carbon dioxide produced in the reaction in (i).

(2)

Q5

(Total 10 marks)

Leave blank

6. First ionisation energy and melting temperature are periodic properties shown by elements.

(a) Define the term **first ionisation energy**.

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(3)

(b) Explain why the first ionisation energy of potassium is less than that of sodium.

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(3)

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(c) The table shows the melting temperatures of the elements of period 3.

	Na	Mg	Al	Si	P (white)	S	Cl	Ar
Melting temperature / K	371	923	933	1683	317	392	172	84
Type of structure								

(i) Complete the table to suggest the type of structure shown by the elements.
Choose your answers from the following list:

giant atomic structure: metallic structure: simple molecular.

(1)

(ii) Explain why silicon has a very high melting temperature.

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(2)

(iii) Explain why aluminium has a higher melting temperature than sodium.

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(2)

Q6

(Total 11 marks)

TOTAL FOR PAPER: 60 MARKS

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THE PERIODIC TABLE

Period	1	2	Group										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	65.4 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

Molar mass g mol^{-1}

Symbol

Name

Atomic number

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	(147) Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	163 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71

232 Th Thorium 90	(231) Pa Protactinium 91	238 U Uranium 92	(237) Np Neptunium 93	(242) Pu Plutonium 94	(243) Am Americium 95	(247) Cm Curium 96	(245) Bk Berkelium 97	(251) Cf Californium 98	(254) Es Einsteinium 99	(253) Fm Fermium 100	(256) Md Mendelevium 101	(254) No Nobelium 102	(257) Lr Lawrencium 103