Centre No.						Paper Reference (complete below)							Surname	Initial(s)
Candidate No.										/			Signature	

Paper Reference(s)

6241/P.01

Edexcel GCE

Chemistry

Advanced Level/Advanced Subsidiary

Unit Test 1

Monday 4 June 2001 – Afternoon

Time: 1 hour 20 minutes

Examiner's use only

Team Leader's use only

Materials required for examination
Nil

Items included with question papers
Nil

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, the paper reference, your signature, surname and initials.
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 question paper.
Show all the steps in any calculations and state the units. Calculators may be used.
Final answers to calculations should be given to an appropriate number of significant figures.
Include diagrams in your answers where these are helpful.
Additional answer sheets may be used.

Information for Candidates

A periodic table is printed on the back cover of this question paper.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are eight questions in this question paper.
The total mark for this paper is 75.

Advice to Candidates

You are reminded of the need to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of your use of grammar, punctuation and spelling.

Turn over

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1. (a) When the Group 2 element calcium is added to water, calcium hydroxide and hydrogen are produced.

Leave blank

Write an equation for the reaction.

.....

(1)

(b) State the trend in solubility of the hydroxides of the Group 2 elements as the atomic mass of the metal increases.

.....

(1)

(c) (i) Define the term **first ionisation energy**, and write an equation to represent the change occurring when the first ionisation energy of calcium is measured.

.....

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.....

(4)

(ii) State and explain the trend in the first ionisation energy of the Group 2 elements.

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.....

.....

.....

(3)

Q1

(Total 9 marks)

2. (a) (i) Complete the electronic configuration of a sulphur atom.

Leave blank

$1s^2$.....

(1)

(ii) Deduce the number of neutrons in the nucleus of an atom of ^{32}S.

.....

(1)

(b) (i) Define the term **first electron affinity**.

.....

.....

.....

(3)

(ii) The following equation represents the change occurring when the **second** electron affinity of sulphur is measured.

$$S^-(g) + e^- \rightarrow S^{2-}(g)$$

Explain why the **second** electron affinity of an element is endothermic.

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.....

.....

(2)

Q2

(Total 7 marks)

3. (a) When a sample of copper is analysed using a mass spectrometer, its atoms are ionised and then accelerated.

Leave blank

(i) Explain how the atoms of the sample are ionised.

.....

.....

.....

(2)

(ii) State how the resulting ions are then accelerated.

.....

.....

(1)

(b) For a particular sample of copper two peaks were obtained in the mass spectrum.

Peak at *m/e*	Relative abundance
63	69.1
65	30.9

(i) Give the formula of the species responsible for the peak at $m/e = 65$.

.....

(1)

(ii) State why **two** peaks, at *m/e* values of 63 and 65, were obtained in the mass spectrum.

.....

(1)

(iii) Calculate the relative atomic mass of this sample of copper, using the table of results above.

(2) **Q3**

(Total 7 marks)

Leave blank

4. (a) Compound **A**, consisting of carbon and hydrogen only, was found to contain 80.0% carbon by mass.

(i) Calculate the empirical formula of compound **A**, using the data above and the periodic table.

(3)

(ii) The relative molecular mass of compound **A** was found to be 30. Use this information to deduce the molecular formula of compound **A**.

(1)

(b) Propane has the molecular formula C_3H_8. Propane burns completely in oxygen to form carbon dioxide and water as shown in the equation.

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$$

(i) Calculate the mass of water produced when 110 g of propane burns completely in oxygen.

(3)

(ii) Calculate the volume of oxygen required to completely burn 110 g of propane. (1 mole of gas has a volume of 24 dm^3 under the conditions of the experiment.)

(2)

Q4

(Total 9 marks)

5. Deduce and draw the shapes of the following molecules or ions. Suggest a value for the bond angle in each case. Give a brief explanation of why each has the shape you give.

Leave blank

(a) SF_6

.....

.....

(3)

(b) PH_3

.....

.....

(3)

(c) PF_4^+

.....

.....

(3)

Q5

(Total 9 marks)

6. (a) The compounds lithium chloride, sodium bromide and potassium iodide can be distinguished from one another by the use of flame tests.

Leave blank

(i) Complete the following table.

Compound	Flame colour
Lithium chloride	
Sodium bromide	
Potassium iodide	

(3)

(ii) Explain the origin of the colours in flame tests.

.....

.....

(2)

(b) These compounds can also be distinguished from one another by the use of concentrated sulphuric acid.

(i) State what would be **seen** when concentrated sulphuric acid is added to separate solid samples of each of these compounds.

Lithium chloride .....

.....

Sodium bromide.....

.....

Potassium iodide .....

.....

(4)

(ii) Write an equation, including the state symbols, for the reaction between solid lithium chloride and concentrated sulphuric acid.

.....

(2)

Q6

(Total 11 marks)

7. (a) Seawater contains aqueous bromide ions. During the manufacture of bromine, seawater is treated with chlorine gas and the following reaction occurs:

Leave blank

$$2Br^- + Cl_2 \rightarrow Br_2 + 2Cl^-$$

(i) Explain the term **oxidation** in terms of electron transfer.

.....

.....

(1)

(ii) Explain the term **oxidising agent** in terms of electron transfer.

.....

.....

(1)

(iii) State which of the elements chlorine or bromine is the stronger oxidising agent and explain the importance of this in the extraction of bromine from seawater, as represented in the equation above.

.....

.....

.....

(2)

(b) When sodium chlorate(I), NaClO, is heated, sodium chlorate(V) and sodium chloride are formed.

(i) Write the **ionic** equation for this reaction.

.....

(2)

(ii) What type of reaction is this?

.....

(1)

(c) During one process for the manufacture of iodine the following reaction occurs:

Leave blank

$$2IO_3^- + 5SO_2 + 4H_2O \rightarrow I_2 + 8H^+ + 5SO_4^{2-}$$

(i) Deduce the oxidation number of sulphur in:

SO_2 .....

SO_4^{2-} .....

(2)

(ii) Use your answers to part (c)(i) to explain whether SO_2 has been oxidised or reduced in the above reaction.

.....

.....

(1)

(iii) Name a reagent that could be used to confirm that a solution contains iodine, and state what would be **seen**.

.....

.....

(2)

Q7

(Total 12 marks)

8. (a) Explain the following observations. Include details of the **bonding** in and the **structure** of each substance.

Leave blank

(i) The melting temperature of diamond is much higher than that of iodine.

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.....

(5)

(ii) Sodium chloride has a high melting temperature (approximately 800 °C).

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(3)

(b) Explain why aluminium metal is a good conductor of electricity.

.....

.....

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(3)

Q8

(Total 11 marks)

TOTAL FOR PAPER: 75 MARKS

END

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	65.4 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