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

Wednesday 18 January 2006 – Morning

Time: 1 hour

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
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, initial(s) and signature.
Answer **ALL** the questions. Write your answers in the spaces provided in this question paper.
You may use a calculator. **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 12 pages in this question paper.
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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Turn over

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Leave blank

Answer ALL questions in the spaces provided.

1. (a) Calcium reacts with water to produce calcium hydroxide and hydrogen.

Write the equation for this reaction. Give TWO observations that could be made during this reaction.

Equation

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Observations

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(4)

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

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(1)

Leave blank

(c) (i) Show that the following data are consistent with the empirical formula CaN_2O_6.

Symbol of element	% by mass
Ca	24.4
N	17.1
O	58.5

(2)

(ii) Explain why the thermal stability of the Group 2 nitrates increases as the atomic number of the Group 2 element increases.

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(3)

Q1

(Total 10 marks)

Leave blank

2. (a) Draw the ammonia molecule, NH_3, making its three-dimensional shape clear. Mark in the bond angle on your diagram. Explain why ammonia has this shape and this bond angle.

Diagram

Explanation

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(4)

(b) Explain whether ammonia is a polar molecule or not.

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(2)

Leave blank

(c) Explain, in terms of the intermolecular forces in both compounds, why ammonia has a higher boiling temperature than phosphine, PH_3.

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(3)

(d) (i) Explain, in terms of electrons, how ammonia can react with hydrogen ions to form ammonium ions, NH_4^+.

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(2)

(ii) State the number of protons and the number of electrons present in an ammonium ion.

number of protons .....

number of electrons .....

(2)

Q2

(Total 13 marks)

Leave blank

3. (a) Sodium chloride, NaCl, can be made by the reaction of sodium with chlorine.

$$2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$$

(i) Calculate the maximum mass of sodium chloride which could be obtained from 92 g of sodium.

(2)

(ii) Calculate the concentration of the solution obtained when this mass of sodium chloride is dissolved in water and made up to a volume of 10 dm^3 with distilled water.

(1)

(iii) Calculate the volume of chlorine gas required to react with 92 g of sodium.

[1 mol of gas occupies 24 dm^3 under the conditions of the experiment]

(2)

Leave blank

(b) Describe the structure of solid sodium metal and explain why it conducts electricity.

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(3)

(c) Explain why sodium chloride has a higher melting temperature than chlorine.

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(3)

(d) (i) Define the term **first ionisation energy**.

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(3)

(ii) Explain why the first ionisation energy of chlorine is higher than that of sodium.

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(2)

(Total 16 marks)

Q3

Leave blank

4. (a) Define the term **oxidising agent** in terms of electron transfer.

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(1)

(b) (i) Suggest which halogen is the strongest oxidising agent.

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(1)

(ii) Which halogen is used to extract bromine from sea water?

.....

(1)

(iii) What is the physical state of bromine at room temperature?

.....

(1)

(c) State the appearance of a gas evolved when concentrated sulphuric acid is added to solid sodium bromide.

.....

(1)

(d) Give the oxidation number of chlorine in each of the following species.

ClO^- .....

ClO_3^- .....

(2)

Leave blank

(e) Chlorine reacts with sodium hydroxide.

Write an **ionic** equation for this reaction and explain, in terms of oxidation numbers, why this is a **disproportionation** reaction.

Equation

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Explanation

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(4)

(f) (i) Write an equation, including state symbols, to show the process that occurs when the **first** electron affinity of chlorine is measured.

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(2)

(ii) Explain why the **second** electron affinity of chlorine would be endothermic.

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(2)

Q4

(Total 15 marks)

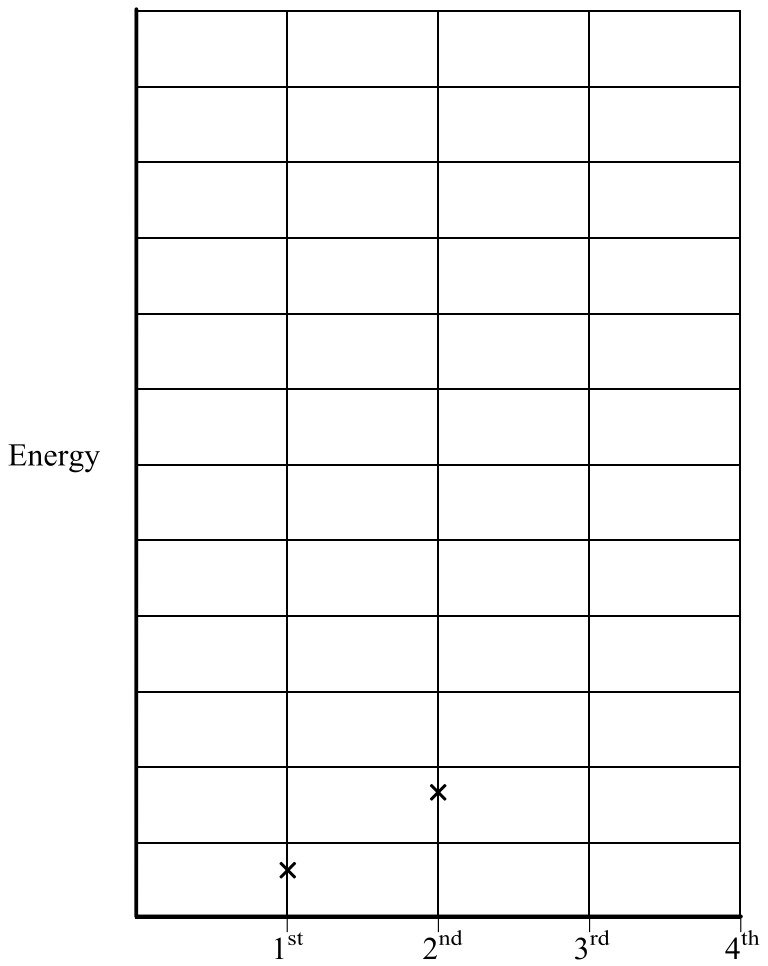
Leave blank

5. (a) (i) Complete the electron configuration of an aluminium atom.

$1s^2$ .....

(1)

(ii) The grid below shows the relative values of the 1st and 2nd ionisation energies of aluminium. Mark on the grid the relative values that you would expect for the 3rd and 4th ionisation energies of aluminium.



(2)

Leave blank

(b) (i) Write the half-equation for the oxidation of aluminium metal to aluminium ions, Al^{3+}.

.....

(1)

(ii) Write the half-equation for the reduction of oxygen gas to oxide ions, O^{2-}.

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(1)

(iii) Combine these two half-equations to produce the redox equation for the reaction of aluminium with oxygen to form aluminium oxide.

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(1)

Q5

(Total 6 marks)

TOTAL FOR PAPER: 60 MARKS

END

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