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

Friday 16 January 2009 – Morning

Time: 1 hour

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
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.
Check that you have the correct question paper. The paper reference is shown above.
Answer **ALL** the questions. Write your answers in the spaces provided in this question paper.
Do not use pencil. Use blue or black ink.
Show all the steps in any calculations and state the units.

Information for Candidates

The marks for individual questions and parts of questions are shown in round brackets: e.g. **(2)**.
The total mark for this paper is 60. There are 16 pages in this question paper. Any 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 table to show the colours and physical states of bromine and iodine at room temperature and pressure.

Halogen	Colour	Physical state
Bromine		
Iodine		

(2)

(b) (i) Explain why hydrogen bromide, HBr, has a lower boiling temperature than hydrogen iodide, HI.

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(2)

(ii) Write the **ionic** equation for the reaction between hydrogen bromide and water. State symbols are **not** required.

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(1)

(iii) Suggest the pH of the solution formed in the reaction in (b)(ii).

.....

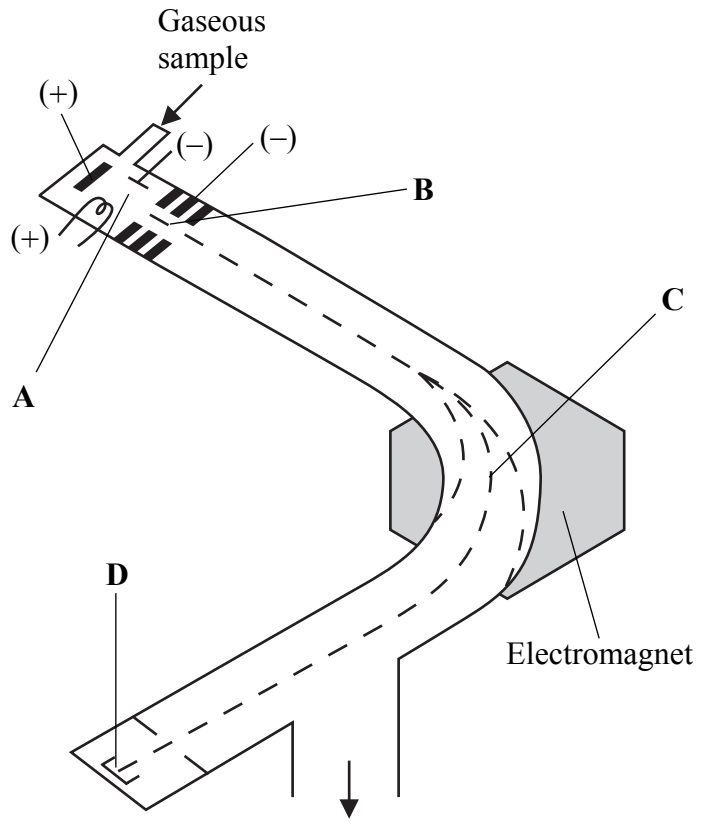
(1)

Q1

(Total 6 marks)

Leave blank

2. (a) A mass spectrometer can be used to determine the isotopic composition of a sample of an element. The diagram below represents a low-resolution mass spectrometer in which four areas have been identified.



Name the process occurring in each of the areas labelled **A**, **B**, **C** and **D**.

Area **A** .....

Area **B** .....

Area **C** .....

Area **D** .....

(4)

Leave blank

(b) Natural boron contains two isotopes with relative isotopic mass of 10.0 and 11.0.

The relative atomic mass of boron is 10.8 (to three significant figures).

Calculate the percentage abundance of the two boron isotopes.

(3) **Q2**

(Total 7 marks)

Leave blank

3. Some atomic radii are given below.

Element	Atomic radius / nm
Sodium, Na	0.191
Aluminium, Al	0.130
Chlorine, Cl	0.099
Potassium, K	0.235

(a) (i) Explain why a chlorine atom has a smaller radius than a sodium atom.

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(2)

(ii) Suggest why a potassium atom has a larger radius than a sodium atom.

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(3)

(b) (i) Complete the electronic configuration of aluminium.

$1s^2$ .....

(1)

Leave blank

(ii) Give the formula of the aluminium ion in aluminium oxide, Al_2O_3.

State and explain how the radius of this ion compares with the radius of an aluminium atom.

Formula of ion .....

Explanation .....

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(2)

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

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(3)

(ii) Explain how successive ionisation energy data show that aluminium is in Group 3 of the Periodic Table.

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(1)

Q3

(Total 12 marks)

Leave blank

4. (a) (i) Draw a 'dot and cross' diagram of boron trifluoride, BF_3, showing the outer shell electrons only.

(2)

(ii) Why is a B–F bond polar?

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(1)

(iii) Explain why the BF_3 molecule is **not** polar.

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(2)

Leave blank

(b) Boron also forms the ion BH_4^-.

(i) State the types of bonding in this ion.

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(2)

(ii) State and explain the shape of the BH_4^- ion.

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(3)

Q4

(Total 10 marks)

Leave blank

5. (a) 1.1 g of a gas, **X**, a compound of carbon and oxygen, occupied a volume of 0.60 dm^3 at room temperature and pressure.

[Molar volume of gas at room temperature and pressure = 24 $dm^3\,mol^{-1}$.]

(i) Calculate the molar mass, in g mol^{-1}, of **X**.

(2)

(ii) Identify the gas, **X**.

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(1)

Leave blank

(b) Magnesium reacts with dilute hydrochloric acid

$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

(i) Calculate the minimum volume of hydrochloric acid of concentration 2.0 mol dm^{-3} which reacts with 6.0 g of magnesium.

(3)

(ii) Calculate the mass of magnesium chloride produced.

(2) **Q5**

(Total 8 marks)

Leave blank

6. (a) (i) A flame test was performed on a sample of sodium chloride. State the colour of the flame.

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(1)

(ii) Explain the origin of the colour obtained in the flame test.

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(3)

(b) (i) Describe the three-dimensional structure of sodium chloride.

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(2)

Leave blank

(ii) Explain why sodium chloride has a high melting temperature.

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(2)

(c) (i) Write the equation for the thermal decomposition of lithium carbonate, Li_2CO_3. State symbols are **not** required.

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(1)

(ii) Explain why sodium carbonate, Na_2CO_3, decomposes with difficulty on heating whereas lithium carbonate decomposes easily.

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(2) **Q6**

(Total 11 marks)

TURN OVER FOR QUESTION 7

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7. (a) Give the oxidation numbers of manganese in

MnO_4^- .....

Mn^{2+} .....

(1)

(b) Write the overall **ionic** equation for the reaction between manganate ions, MnO_4^-, and hydrogen peroxide, H_2O_2, given the half-equations

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$

$$H_2O_2 \rightarrow O_2 + 2H^+ + 2e^-$$

(2)

(c) Hydrogen peroxide can decompose as follows

$$2H_2O_2 \rightarrow O_2 + 2H_2O$$

State and explain, using oxidation numbers, the type of reaction that is occurring.

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(3) **Q7**

(Total 6 marks)

TOTAL FOR PAPER: 60 MARKS

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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