Paper Reference(s)

6241/01

Edexcel GCE

Chemistry

Advanced Subsidiary

Unit Test 1

Wednesday 6 June 2007 – Morning

Time: 1 hour

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.
One of the questions in this paper must be answered with a cross in a box (⊠). If you change your mind about an answer, put a line through the box (⊠) and then mark your new answer with a cross (⊠).
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.

Turn over

edexcel
advancing learning, changing lives

BLANK PAGE

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

1. (a) Complete the table below which is about the isotopes and an ion of bromine.

	Number of		
	protons	neutrons	electrons
$^{79}_{35}Br$	35		35
$^{81}_{35}Br$		46	35
$^{81}_{35}Br^-$	35	46	

(3)

(b) Complete the electronic configurations of

Na $1s^2$...

Br $1s^2$ ....

(2)

(c) Explain why the isotopes of bromine have identical chemical reactions.

....

....

....

(1)

(d) What instrument could be used to measure the abundance and mass of the isotopes of bromine?

....

(1)

(e) The isotopic abundance of bromine is shown below.

Relative isotopic mass	Percentage abundance
78.93	50.54
80.91	49.46

Calculate the relative atomic mass of bromine. Give your answer to **four** significant figures.

(2)

(f) State the types of bonding present in bromine **liquid**

between the atoms   ....

between the molecules...
(2)

(g) What colour is liquid bromine?

....
(1)

(h) State the colour produced by sodium compounds in a flame test.

....
(1)

(i) Sodium reacts with bromine to produce sodium bromide. Write the equation for this reaction.

....
(1)

(j) State the type of bond present in solid sodium.

....
(1)

(k) State the type of bond that exists in sodium bromide.

Draw a dot and cross diagram of sodium bromide, showing only the outer shell electrons.

Type ....

Dot and cross diagram

(3)

(Total 18 marks)

Q1

2. (a) Write the equations to show the action of heat on the following solid nitrates. State symbols are **not** required.

   (i) lithium nitrate, $LiNO_3$.

   ....

   (2)

   (ii) caesium nitrate, $CsNO_3$.

   ....

   (1)

(b) The solubilities of the sulphates and hydroxides of calcium and barium are shown below. Use the information **in the table** to answer the questions that follow.

Substance	Solubility	Substance	Solubility
$CaSO_4$	slightly soluble	$Ca(OH)_2$	slightly soluble
$BaSO_4$	insoluble	$Ba(OH)_2$	soluble

   (i) Both calcium and barium metals react with water to give the metal hydroxide and hydrogen gas.

   What **difference** would you expect to **see** after calcium metal and barium metal have reacted with water?

   ....

   ....

   ....

   ....

   ....

   (2)

(ii) The reaction between barium metal and excess dilute sulphuric acid stops after a very short time. Suggest an explanation for this.

....

....

....

....

....

....

(2)

(c) Suggest the solubility in water of radium sulphate. Put a cross (☒) in the correct box.

A	Very soluble	☒
B	Soluble	☒
C	Slightly soluble	☒
D	Insoluble	☒

(1)

(d) Write the **ionic** equation for the reaction of calcium metal with dilute hydrochloric acid. Include state symbols in your equation.

....

(2)   **Q2**

(Total 10 marks)

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

....

....

....

....

....

....

(3)

(ii) Write the equation for the process occurring when the **second** ionisation energy of oxygen is measured.

....

(1)

(b) The graph below shows the first seven successive ionisation energies of an element, **X**, which is in **Period 3** of the Periodic Table.

Ionisation energy /kJ mol^{-1}

Number of the electron removed

N 2 6 0 2 1 A 0 8 1 6
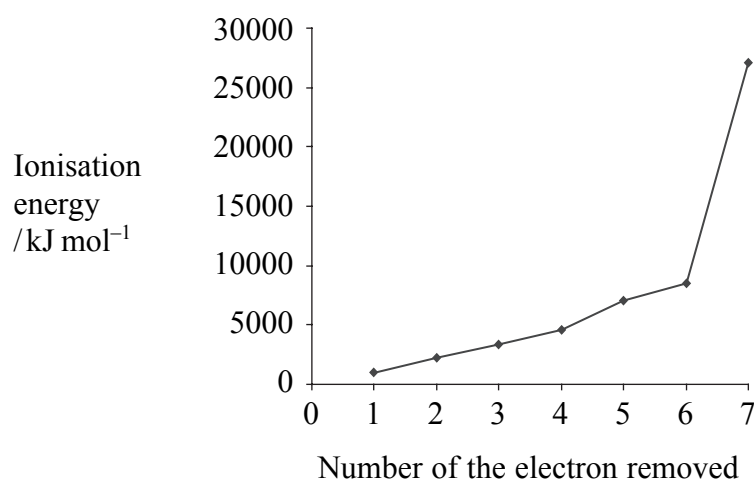
(i) Use the information on the graph to state in which **Group** of the Periodic Table **X** is found. Justify your answer.

....

....

....

....

(2)

(ii) Identify the element **X**.

....

(1)

(c) The mass spectrum of **X** shows a singly charged molecular ion at *m/e* = 256.

Write the formula of this ion.

....

(2)   **Q3**

(Total 9 marks)

Turn over

4. (a) **Describe** the three-dimensional arrangement of the ions or atoms in the following solids:

(i) sodium chloride

....

....

....

....

....

....

(2)

(ii) graphite

....

....

....

....

....

....

(2)

(b) Graphite is quite soft and is used in pencils.

Explain how its use in pencils depends on the bonding in graphite.

....

....

....

....

....

....

....

....

(2)

(c) Explain **how** the following conduct electricity.

(i) molten sodium chloride

....

....

....

....

....

(1)

(ii) solid graphite

....

....

....

....

....

....

(1) Q4

(Total 8 marks)

5. (a) Define **reduction** in terms of change in oxidation number.

....

....

(1)

(b) The reaction between solid sodium halides and concentrated sulphuric acid changes
as the group is descended.

(i) Complete the balancing of the equation for the reaction of **sodium bromide** with
concentrated sulphuric acid.

$NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$

$2NaBr + ...H_2SO_4 \rightarrow ......NaHSO_4 + ...SO_2 + ...Br_2 + ...H_2O$

$8NaI + 9H_2SO_4 \rightarrow 8NaHSO_4 + H_2S + 4I_2 + 4H_2O$

(1)
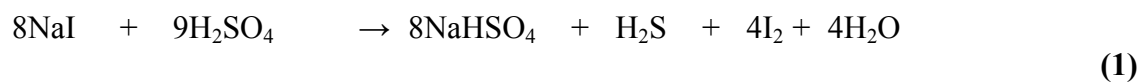
(ii) Write the oxidation numbers of **sulphur** in the following:

H_2SO_4 ....

$NaHSO_4$ ....

SO_2 ....

H_2S ....

(2)

(iii) Use the **changes** in oxidation number of **sulphur** in the reactions in (i) to
show that the halides become more powerful reducing agents as the group is
descended.

....

....

....

....

....

....

(2)

Q5

(Total 6 marks)

TURN OVER FOR QUESTION 6

6. (a) Define the term **Avogadro constant**.

....

....

....

(2)

(b) **Z** is a Group 0 element.

(i) 1.907 g of **Z** contains 2.87×10^{22} atoms of **Z**.

Calculate the relative atomic mass of **Z**.

[Avogadro constant $= 6.02 \times 10^{23}$ mol^{-1}]

(2)

(ii) Suggest the identity of **Z**.

....

(1)

(c) Potassium superoxide, KO_2, reacts with water as follows:

$$2KO_2(s) \; + \; 2H_2O(l) \; \rightarrow \; 2KOH(aq) \; + \; H_2O_2(aq) \; + \; O_2(g)$$

(i) Calculate the mass of potassium superoxide needed to produce 3.09 g of hydrogen peroxide.

[Molar mass of potassium superoxide, KO_2 : 71 g mol^{-1}. Molar mass of hydrogen peroxide, H_2O_2 : 34 g mol^{-1}]

(3)

(ii) Calculate the volume of oxygen produced from the reaction in (i).

[Molar volume of oxygen under the conditions of the reaction $= 24.0$ dm^3 mol^{-1}]

(1) Q6

(Total 9 marks)

TOTAL FOR PAPER: 60 MARKS

END

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	65.4 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