Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	2	4	3	/	0	2	Signature	

Paper Reference(s)

6243/02

Edexcel GCE

Chemistry

Advanced Subsidiary

Unit Test 3B

Wednesday 7 June 2006 – Morning

Time: 1 hour

Materials required for examination
Nil

Items included with question papers
Nil

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
Total	

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 50. The marks for the individual questions and parts of questions are shown in round brackets: e.g. (**2**). There are 12 pages in this question paper. Any blank pages are indicated.
A Periodic Table is printed on the back cover of this booklet.
You may use a calculator.

Advice to Candidates

You are reminded of the importance of clear English and careful presentation in your answers. You will be assessed on your Quality of Written Communication in this paper.

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

1. The reactions of two solid salts **A** and **B** are given in the tables below. In each case complete the inference column and identify the solid.

(a)

Test	Observations	Inference
Solid **A** was heated with sodium hydroxide solution and the gas evolved tested with damp red litmus paper.	Colourless gas evolved that turned damp red litmus blue.	Gas evolved ..... Cation in **A** .....
Barium chloride solution and dilute hydrochloric acid were added to a solution of **A**.	White precipitate produced.	Anion in **A** .....

Formula of **A** .....

(4)

(b) **B** contains three elements.

Test	Observations	Inference
Flame test on solid **B**.	Bright yellow flame.	Cation .....
Heat solid **B** and test gas evolved with glowing splint.	Glowing splint ignited.	Gas evolved .....
Dissolve the **residue** from the heating of solid **B** in water. Add silver nitrate solution and dilute nitric acid. Test any precipitate formed with dilute ammonia solution.	White precipitate formed which dissolves in dilute ammonia solution.	Anion in residue .....

Suggest a name, or formula, for the solid compound **B**.

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(4) **Q1**

(Total 8 marks)

Leave blank

2. Suggest how samples of the following substances can be distinguished. You should give a **positive** test for each compound.

(a) Carbon dioxide gas and sulphur dioxide gas.

Carbon dioxide .....

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Sulphur dioxide .....

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(3)

(b) A solution of sodium carbonate and a solution of sodium hydrogencarbonate. You are **not** required to prove that sodium is present.

Sodium carbonate .....

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Sodium hydrogencarbonate .....

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(4) **Q2**

(Total 7 marks)

Leave blank

3. Before a solution of hydrochloric acid can be used in volumetric analysis, its concentration must be found accurately.

(a) Suggest why hydrochloric acid cannot be made up as an accurate (standard) solution from pure hydrogen chloride.

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(1)

(b) The accurate concentration of a solution of hydrochloric acid can be found by titrating it against a standard solution of sodium carbonate.
This is made by dissolving a known mass of anhydrous sodium carbonate, Na_2CO_3, in distilled water. Distilled water is added to make the solution up to exactly 250 cm^3 in a graduated flask.

Give ONE reason why the sodium carbonate is dissolved in distilled water and then made up to 250 cm^3 of solution, rather than just dissolved in 250 cm^3 of distilled water.

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(1)

(c) The following results were obtained for the titration of 25.0 cm^3 of 0.0500 mol dm^{-3} sodium carbonate solution, Na_2CO_3, against hydrochloric acid.

$$Na_2CO_3 + 2HCl \longrightarrow 2NaCl + CO_2 + H_2O$$

Number of titration	1	2	3
Burette reading (final) / cm^3	31.10	32.55	30.30
Burette reading (initial) / cm^3	0.00	2.05	0.00
Volume of HCl used / cm^3	31.10	30.50	30.30

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(i) Which TWO titrations should be used to calculate the mean (average) titre? Explain your answer.

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(2)

(ii) Calculate the mean titre.

(1)

(iii) Calculate the amount (moles) of sodium carbonate, Na_2CO_3, in 25.0 cm^3 of the 0.0500 mol dm^{-3} solution.

(1)

(iv) Hence calculate the amount (moles) of hydrogen chloride, HCl, used.

(1)

(v) Calculate the concentration of the hydrochloric acid solution to **three** significant figures.

(2) **Q3**

(Total 9 marks)

Leave blank

4. A metal carbonate decomposes on heating to give an oxide and carbon dioxide.

$$XCO_3(s) \longrightarrow XO(s) + CO_2(g)$$

where **X** is the metallic element.

In an experiment to find the identity of **X**, 5.75 g of the solid XCO_3 was heated until there was no further change in mass; 3.55 g of solid XO was produced.

(a) Explain why it was necessary to heat the carbonate until there was no further change in mass.

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(1)

(b) (i) Calculate the mass of carbon dioxide gas given off.

(1)

(ii) Calculate the amount (moles) of carbon dioxide gas given off.

(1)

(iii) Use the answer from (ii) to state the amount (moles) of XCO_3 in 5.75 g of the solid.

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(1)

(iv) Calculate the molar mass of XCO_3.

(1)

(v) Use your answer from (iv) and the relative atomic masses of carbon and oxygen to calculate the relative atomic mass of **X** in XCO_3.

(1)

Leave blank

(c) All measurements of mass have some uncertainty. In this case, this leads to an error of ±0.91 % in the molar mass of XCO_3.

(i) Use this information and your answer to (b)(iv) to calculate the error in the molar mass of XCO_3.

(1)

(ii) Hence suggest the range of possible values for the molar mass of XCO_3.

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(1)

(iii) Hence give the range of possible values of the relative atomic mass of **X**.

(1)

(iv) Use the Periodic Table and your answer to (c)(iii) to suggest possible identities of metal **X**.

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(1)

Q4

(Total 10 marks)

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5. (a) An organic compound **Z** undergoes the following reactions. Complete the table.

Test	Observation	Inference
Bromine water was added drop by drop to **Z**.	Bromine water goes from brown to colourless.	Functional group present in **Z** .....
Solid PCl_5 was added to **Z**.	Steamy fumes were evolved which turned damp blue litmus red.	Functional group present in **Z** .....

(2)

(b) **Z** has a molecular formula of C_4H_8O.

Suggest the structural formulae of TWO possible isomers of **Z**.

Isomer I

Isomer II

(2) **Q5**

(Total 4 marks)

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6. Halogenoalkanes react with water to produce alcohols and the halide ion.

$$C_4H_9Y + H_2O \longrightarrow C_4H_9OH + Y^- + H^+$$

(a) The instructions for an experiment to investigate the effect of different halogens on the rate of the substitution reaction are as follows.

- Place 1 cm^3 of ethanol in each of three test tubes.
- To one tube add 2 drops of 1-chlorobutane, to the second add 2 drops of 1-bromobutane, and to the third add 2 drops of 1-iodobutane.
- Stand the test tubes in a beaker of hot water.
- When the solutions have reached about 60 °C, add 1 cm^3 of aqueous silver nitrate (also at 60 °C) to each tube and start the clock.
- Shake the tubes.
- Note the time taken for a precipitate to form in each tube, and its colour.

(i) Suggest why ethanol was added to each of the tubes.

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(1)

(ii) Suggest ONE reason why the test tubes were put in the same beaker of hot water.

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(1)

(iii) Suggest ONE reason why the reaction was carried out at about 60 °C, rather than at room temperature.

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(1)

Leave blank

(b) State how your observations during the experiment described in (a) could be used to identify which halogen was present in each halogenoalkane. What additional test should be carried out to confirm this? What results would you expect?

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(3)

(c) Outline a test tube experiment, **based on the experiment in (a)**, to investigate how the rate of substitution depends on whether the halogenoalkane is primary, secondary or tertiary.

Base your experiment on the isomeric halogenoalkanes with the formula C_4H_9Br reacting with water.

Your plan should include

- the chemicals you will use
- an outline of how the experiment will be carried out
- the observations or measurements you will make and how you will interpret them

(6)

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Q6

(Total 12 marks)

TOTAL FOR PAPER: 50 MARKS

END

N 2 2 4 2 6 A 0 1 1 1 2

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