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

Thursday 17 January 2008 – 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

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 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 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 booklet.

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. (a) Potassium dichromate(VI) solution acidified with dilute sulphuric acid is an oxidising agent. It is used to show the presence of some chemical compounds which can be oxidised.

State the colour change that occurs when an acidified solution of potassium dichromate(VI) is reduced.

From ..... to .....

(1)

(b) Identify the following compounds from their behaviour when treated with acidified potassium dichromate(VI) solution

(i) A pungent acidic gas which is readily oxidised.

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(1)

(ii) TWO colourless organic liquids, both of formula $C_4H_{10}O$, which are oxidised on heating.

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(2)

(iii) A colourless organic liquid, also of formula $C_4H_{10}O$, which resists oxidation even on heating.

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(1)

Leave blank

(c) Aluminium powder in sodium hydroxide solution is a reducing mixture which can be used in tests to identify certain ions. (Zinc or Devarda's alloy can also be used in place of the aluminium.)

(i) Identify an anion that can be detected by its reaction with one of these mixtures.

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(1)

(ii) Identify the gas produced when the reaction in (i) occurs.

.....

(1)

(iii) Describe a test to show the gas in (ii) is present. Give the positive result of this test.

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(1)

(d) A compound containing the anion detected in (c)(i), was thought to contain either lithium or sodium cations.

Describe how you would carry out a flame test to identify the metal ion present, giving the result for each cation.

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(4)

Q1

(Total 12 marks)

Leave blank

2. You are provided with a clean, dry weighing bottle containing 2.45 g of pure anhydrous sodium carbonate, Na_2CO_3.

(a) Describe how you would prepare exactly 250 cm^3 of a standard solution containing **all** of this sodium carbonate.

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(5)

(b) Calculate the concentration of the sodium carbonate solution in mol dm^{-3}, giving your answer to **3** significant figures.

(3)

Leave blank

(c) 25.0 cm^3 samples of the sodium carbonate solution were titrated against aqueous hydrochloric acid using methyl orange indicator.

The equation for the reaction is

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

The results of three titrations (in cm^3) were: 29.10, 28.60 and 28.70.

(i) State the colour change at the end-point of the titration.

From ..... to .....

(1)

(ii) Calculate the mean (or average) titre that you would use to calculate the concentration of the hydrochloric acid.

(1)

(iii) Use your mean titre and the concentration of the sodium carbonate solution from (b) to calculate the concentration of the hydrochloric acid in mol dm^{-3}.

If you have been unable to calculate the concentration of the sodium carbonate solution in (b) use a value of 1.50 mol dm^{-3} (this is **not** the correct answer to (b)).

(3) **Q2**

(Total 13 marks)

Leave blank

3. 1-bromopropane may be prepared from propan-1-ol using the following method:

- Propan-1-ol, water and solid sodium bromide are mixed in a flask and 50 % sulphuric acid is added, a little at a time, with cooling.
- The mixture is heated under reflux and then distilled.
- The distillate is mixed with sodium carbonate solution in a separating funnel and the lower organic layer removed.
- Solid anhydrous calcium chloride is added to the organic layer, which is finally distilled. The distillate boiling in the range 70–72 °C is collected.

The reaction may be represented by the following equation:

$$CH_3CH_2CH_2OH + HBr \rightarrow CH_3CH_2CH_2Br + H_2O$$

Hazard information about 1-bromopropane

- flammable
- harmful by skin absorption

(a) (i) Why is the mixture cooled while the sulphuric acid is added?

.....

.....

(1)

Leave blank

(ii) Draw a labelled diagram of the apparatus used for heating under reflux.

(3)

(iii) What property of 1-bromopropane allows it to be separated from the sodium carbonate solution using a separating funnel?

.....

(1)

(iv) What is the purpose of the anhydrous calcium chloride?

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(1)

(v) Suggest a safety precaution (other than the use of a fume cupboard, laboratory coat or safety goggles) that would be appropriate for this experiment.
Give a reason for your choice.

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(2)

Leave blank

(b) (i) Calculate the theoretical maximum mass of 1-bromopropane that could be obtained from 7.55 g of propan-1-ol.

[Molar masses/g mol^{-1} : propan-1-ol 60.0, 1-bromopropane 123]

(2)

(ii) In the actual experiment 8.30 g of 1-bromopropane was obtained.
Calculate the percentage yield of the reaction.

(1)

(iii) Suggest a reason why the yield is less than 100 %.

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(1)

Q3

(Total 12 marks)

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4. The enthalpy change for the reaction between aqueous sodium hydroxide solution and aqueous hydrochloric acid was determined by the following method:

- Aqueous hydrochloric acid was titrated against 25.0 cm^3 of 1.50 mol dm^{-3} aqueous sodium hydroxide solution using a suitable indicator. The mean (or average) titre was 22.75 cm^3.
- 25.0 cm^3 of the sodium hydroxide solution was carefully measured into a polystyrene cup and 22.75 cm^3 of the hydrochloric acid was transferred to a clean dry beaker. Both solutions were allowed to stand for five minutes before their temperatures were noted.
- The hydrochloric acid was then added to the sodium hydroxide solution, the mixture stirred thoroughly and the highest temperature noted.
- The experiment was repeated three times giving an average temperature change of +10.5 °C.

(a) (i) Explain why the titration was carried out.

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(1)

(ii) Why was it necessary to allow the two solutions to stand before mixing?

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(1)

Leave blank

(b) (i) Calculate the heat produced in the reaction, in joules.
Use the approximations that the density of the final solution is 1.00 g cm^{-3} and its specific heat capacity is 4.18 J g^{-1} K^{-1}.

(2)

(ii) Calculate the enthalpy change for the reaction, in kJ mol^{-1}.

(3)

(c) State ONE assumption made when calculating this enthalpy change, other than those stated in (b)(i).

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(1) **Q4**

(Total 8 marks)

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5. It is suggested that when a more reactive metal displaces a less reactive metal from a solution of its salts, the enthalpy of reaction increases as the difference in reactivity between the two metals increases.

Plan an experiment to test this suggestion for magnesium displacing the metals copper, lead and zinc from solutions of their salts.

You are provided with magnesium powder and solutions of copper(II) sulphate, lead(II) nitrate and zinc nitrate (all of concentration 0.5 mol dm^{-3}), the usual laboratory glassware, 150 cm^3 polystyrene cups, an accurate thermometer and access to a balance.

In your plan you should:

- indicate the amounts of each substance you would use
- outline the procedure
- state the measurements you would make
- state how you would use your results to test this suggestion.

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Q5

(Total 5 marks)

TOTAL FOR PAPER: 50 MARKS

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THE PERIODIC TABLE

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