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 6 June 2007 – Morning

Time: 1 hour

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
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) Salt **A** contains one cation and one anion.

When a sample of **A** is heated with aqueous sodium hydroxide a gas, **B**, is given off that turns damp red litmus paper blue.

When dilute hydrochloric acid followed by aqueous barium chloride is added to a solution of **A**, a white precipitate, **C**, is formed.

Identify **A**, **B** and **C**.

A .....

B .....

C .....

(3)

(b) Salt **D** contains one cation and one anion.

When a flame test is carried out on **D**, a lilac colour is observed in the flame.

When concentrated sulphuric acid is added to **D**, brown fumes of an element, **E**, are given off together with a colourless gas, **F**.

F turns acidified potassium dichromate(VI) green.

Identify **D**, **E**, and **F**.

D .....

E .....

F .....

(3) **Q1**

(Total 6 marks)

Leave blank

2. A mixture contains 100 g of calcium carbonate, $CaCO_3$, and 10 g of sodium carbonate, Na_2CO_3, as an impurity.

Compound	Solubility at 20 °C
Calcium carbonate	Insoluble in water
Sodium carbonate	21 g in 100 cm^3 water

(a) Describe how you would use the difference in solubilities of the two compounds to remove the sodium carbonate from the mixture.

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(4)

(b) Give a test and its expected result to show that all the sodium carbonate has been removed.

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(1)

Q2

(Total 5 marks)

Leave blank

3. A halogenoalkane, **Y**, has the molecular formula C_4H_9X, where X represents a halogen atom.

When **Y** is heated with excess aqueous sodium hydroxide, it is converted into **Z**, $C_4H_{10}O$.

Complete the tables below.

(a)

Test	Observation	Inference
To the solution remaining after heating **Y** with excess aqueous sodium hydroxide, add .... followed by aqueous silver nitrate.	White precipitate	The atom **X** is .....

(2)

(b)

Test	Observation	Inference
Add phosphorus pentachloride to pure **Z**. Test the gas evolved with damp blue litmus paper.	..... fumes were seen at the mouth of the test tube. The litmus paper turned red.	The gas evolved is ..... **Z** is an alcohol.

(2)

(c)

Test	Observation	Inferences
Warm **Z** with acidified aqueous potassium dichromate(VI).	....	**Z** is not oxidised. **Z** is a ..... alcohol.

(2)

Leave blank

(d) Based on the observations and inferences in (a) to (c), draw the structural formula of **Y**.

(1)

Q3

(Total 7 marks)

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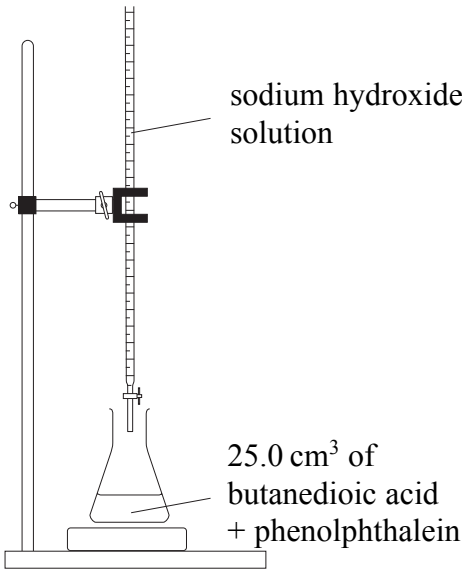
4. A titration is carried out by adding sodium hydroxide solution from a burette to 25.0 cm^3 of aqueous 0.0500 mol dm^{-3} butanedioic acid, $(CH_2COOH)_2$, to which a few drops of phenolphthalein have been added.

$$(CH_2COOH)_2(aq) + 2NaOH(aq) \longrightarrow (CH_2COONa)_2(aq) + 2H_2O(l)$$

Diagram I



(a) A preliminary ('rough') titration shows that between 23.0 cm^3 and 24.0 cm^3 of sodium hydroxide is required to react with the butanedioic acid solution.

Describe the procedure you would follow, using the apparatus shown in **Diagram I**, for a second, accurate titration. Include in your description the colour change at the end point.

.....

.....

.....

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.....

.....

.....

(4)

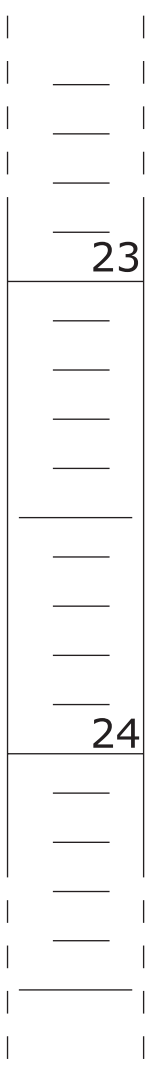
Leave blank

(b) The burette readings recorded by a student carrying out the titrations are shown in the table below.

Titration numbers	1	2	3
Burette reading (final)/cm^3	23.90	23.60	23.65
Burette reading (initial)/cm^3	0.00	0.00	0.15
Titre/cm^3	23.90	23.60	23.50
Used in mean (✓)			

(i) On **Diagram II** below, show the level of the sodium hydroxide solution when the final burette reading is recorded in **titration 3**.

Diagram II



(1)

Leave blank

(ii) Calculate the mean (or average) titre.

Show which titres you have used in your calculation by putting a tick (✓) in the appropriate boxes in the table on page 8.

(2)

(c) (i) Calculate the amount (moles) of butanedioic acid, $(CH_2COOH)_2$, in 25.0 cm^3 of the 0.0500 mol dm^{-3} solution.

(1)

(ii) Calculate the amount (moles) of sodium hydroxide, NaOH, in the mean titre.

(1)

(iii) Calculate the concentration of the sodium hydroxide solution in mol dm^{-3}. Give your answer to **three** significant figures.

(1)

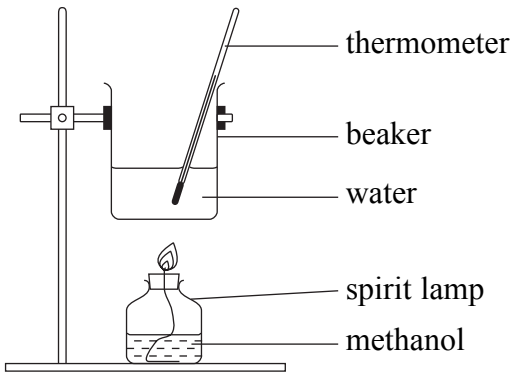
Q4

(Total 10 marks)

Leave blank

5. The apparatus used and the recordings made by a student, carrying out an experiment to determine the enthalpy of combustion of methanol, are shown below.

Diagram



Results

Molar mass (methanol) = 32 g mol^{-1}
Volume of water in beaker = 50 cm^3
Mass of water in beaker = 50 g

Weighings
Spirit lamp + methanol before combustion = 163.78 g
Spirit lamp + methanol after combustion = 163.44 g

Temperatures
Water before heating = 22.0 °C
Water after heating = 43.5 °C

Specific heat capacity of water = 4.18 J g^{-1} $°C^{-1}$

Observations

- When the spirit lamp was being weighed its mass was continually falling.
- A black substance formed on the bottom of the beaker as the methanol burned.

Leave blank

(a) (i) Calculate the amount (moles) of methanol, CH_3OH, burned.

(2)

(ii) Calculate the heat gained by the water. Give your answer in kJ.

(2)

(iii) Use your values from (i) and (ii) to calculate the enthalpy of combustion of methanol in kJ mol^{-1}. Include a sign with your answer.

ΔH = ... kJ mol^{-1}

(2)

(b) (i) The thermometer used in the experiment can be read to an accuracy of ±0.5 °C. Calculate the percentage error in the temperature change.

(1)

(ii) Calculate the maximum temperature change that could have occurred during the experiment.

(1)

Leave blank

(c) (i) Give a reason why the mass of the spirit lamp fell as it was being weighed.

.....

.....

(1)

(ii) Suggest the identity of the black substance that forms on the beaker. State the effect on the value of the enthalpy of combustion obtained.

.....

.....

.....

(2)

Q5

(Total 11 marks)

Leave blank

6. In an experiment to prepare iodoethane, solid moist red phosphorus is placed into a flask to which ethanol is added. The flask is then arranged as shown in **Apparatus I**.

20.0 g of powdered iodine is then added to the flask in small portions. Before each addition the condenser is removed, the iodine is added and the condenser is immediately replaced. At least two minutes must be allowed between additions of iodine.

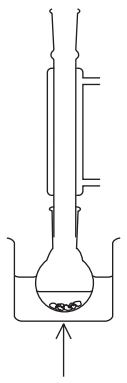
When all the iodine has been added, the flask is allowed to stand for about 10 minutes and is then heated for an hour in **Apparatus I**.

$$2P + 3I_2 \longrightarrow 2PI_3$$

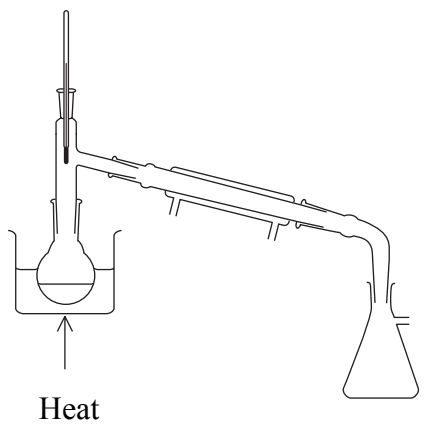
$$3CH_3CH_2OH + PI_3 \longrightarrow 3CH_3CH_2I + H_3PO_3$$

The iodoethane is then removed from the reaction mixture, purified and dried. A final purification is then carried out using **Apparatus II**. Iodoethane is collected over a narrow temperature range.

Apparatus I



Apparatus II



Data

Ethanol: colourless liquid, flammable, boiling temperature 78 °C
Iodoethane: colourless liquid, flammable, boiling temperature 72 °C

(a) (i) Give the name of the practical technique carried out in each apparatus shown above.

Apparatus I .....

Apparatus II .....

(2)

(ii) Explain why it is important that a stopper should **not** be placed in the top of the condenser in **Apparatus I**.

.....

.....

(1)

Leave blank

(b) (i) Suggest a reason why the iodine is added in small portions and over a period of time.

.....

.....

(1)

(ii) Give ONE reason why water baths are used in both **Apparatus I** and **Apparatus II**, rather than heating the flasks directly with a Bunsen flame.

.....

.....

.....

(1)

(iii) Why is the reaction mixture in **Apparatus I** heated for such a long time after all the iodine has been added?

.....

.....

(1)

(iv) Suggest the readings on the thermometer in **Apparatus II** between which iodoethane should be collected.

From ..... to .....°C

(1)

Leave blank

(c) (i) Calculate the amount (moles) of iodine molecules, I_2, in 20.0 g of iodine.

(1)

(ii) Calculate the maximum mass of iodoethane that would be formed from 20.0 g of iodine.

[molar mass iodoethane = 156 g mol^{-1}]

(2)

(iii) In such a preparation, the yield of iodoethane was 16.7 g. Calculate the percentage yield.

(1) **Q6**

(Total 11 marks)

TOTAL FOR PAPER: 50 MARKS

END

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