Centre No.						Paper Reference (complete below)							Surname	
Candidate No.									/				Signature	

Paper Reference(s)

6243B.P01

Edexcel GCE

Advanced/Advanced Subsidiary

Unit Test 3B

Friday 18 January 2002 – Morning

Time: 1 hour

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, surname and initials, the paper reference and your signature. The paper reference is shown above. If more than one paper reference is shown, you should write the one for which you have been entered.
Answer ALL questions in the spaces provided in this book.
Show all the steps in any calculations and state the units of the answer.
Calculators may be used.

Information for Candidates

A Periodic Table is printed on the back cover of this question paper.
The total mark for this paper is 50. The marks for the various questions are shown in round brackets: e.g. (2).
There are four questions in this question paper. All blank pages are indicated.

Advice to Candidates

You are reminded of the importance of clear and orderly presentation in your answers.

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1. (a) The observations made when tests were carried out on a solid compound, **X**, are shown in the tables below. **X** contains one metal ion and one anion.

Leave blank

Give the inferences which follow the observations by completing the statements in the tables.

(i) A flame test was carried out on **X**.

Observation	Inference
A lilac flame.	The metal ion is .....

(1)

(ii) A sample of **X** was heated and the gas evolved tested.

Observation	Inferences
A gas is given off which relights a glowing spill.	The gas is ..... **X** has the formula .....

(2)

(b) The observations made when tests were carried out on an aqueous solution, **Y**, are shown in the tables below.
Give the inferences which follow the observations by completing the statements in the tables.

(i) Powdered sodium hydrogencarbonate was added to **Y** in a test tube. Any gas evolved was tested.

Observations	Inferences
Bubbles of gas evolved. The gas turns lime water cloudy.	The gas is .....
	Y contains ..... ions

(2)

23

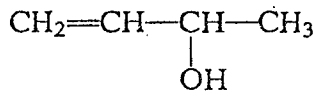
(ii) A few drops of aqueous barium chloride followed by dilute aqueous hydrochloric acid was added to **Y**.

Leave blank

Observations	Inferences
White precipitate which does not dissolve in dilute aqueous hydrochloric acid.	The precipitate is ..... **Y** is aqueous .....

(2)

(c) The organic compound, **Z**, has the structure:



Complete the table by writing the observations you would expect to make when the tests described are carried out.

Tests	Observations
Shake a few drops of **Z** with bromine solution.	
Add phosphorus pentachloride to **Z**. Test any gas evolved with damp blue litmus paper.	
Add aqueous, potassium dichromate(VI), acidified with aqueous sulphuric acid, to **Z** and heat the solution.	

(6)

(Total 13 marks)

Q1

24

2. In a series of experiments to investigate the factors which control the rate of a chemical reaction, aqueous hydrochloric acid was added to calcium carbonate in a conical flask placed on an electronic balance.
The loss in mass of the flask and its contents was recorded for 15 minutes.

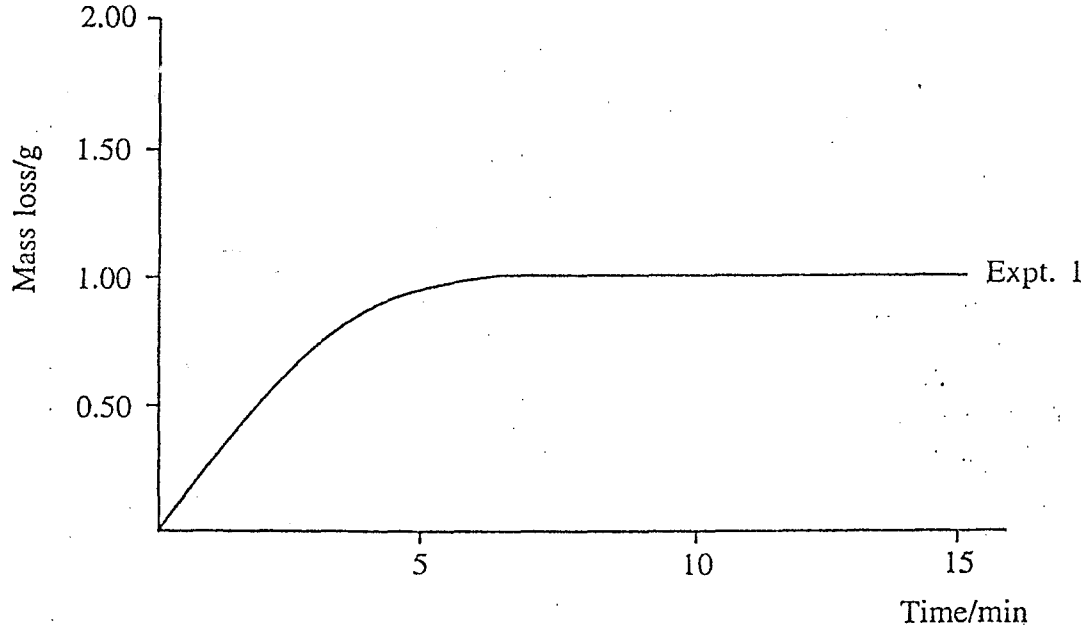
Leave blank

$$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

Four experiments were carried out.
Experiments **1**, **3** and **4** were carried out at room temperature (20 °C).
The same mass of calcium carbonate (a large excess) was used in each experiment.
The pieces of calcium carbonate were the same size in Experiments **1**, **2** and **4**.

Experiment	Calcium carbonate	Hydrochloric acid
1	Small pieces	50.0 cm^3 of 1.00 mol dm^{-3}
2	Small pieces	50.0 cm^3 of 1.00 mol dm^{-3} heated to 80 °C
3	One large piece	50.0 cm^3 of 1.00 mol dm^{-3}
4	Small pieces	50.0 cm^3 of 2.00 mol dm^{-3}

(a) The results of Experiment **1** give the curve shown on the graph below.



(i) Explain why there is a loss in mass as the reaction proceeds.

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(2)

25

(ii) Explain the shape of the curve drawn for Experiment **1**.

Leave blank

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(2)

(b) Draw **curves on the graph** to represent the results you would expect for Experiments **2**, **3** and **4**. Label the curves **2**, **3** and **4**.

(3)

(c) (i) Calculate the mass of calcium carbonate which exactly reacts with 50.0 cm^3 of 1.00 mol dm^{-3} aqueous hydrochloric acid. $M_r(CaCO_3) = 100$.

(3)

(ii) Based on your answer to (c)(i) suggest a suitable mass of calcium carbonate to use in the experiments. Explain your answer.

Suggested mass: .....

Explanation: .....

.....

.....

(2)

Q2

(Total 12 marks)

26

3. 1-bromobutane (boiling temperature 102 °C) may be prepared by the reaction shown in the equation below.

Leave blank

$$C_4H_9OH + NaBr + H_2SO_4 \longrightarrow C_4H_9Br + NaHSO_4 + H_2O$$

The preparation is in three stages.

- Stage I: The reagents are heated for about 45 minutes in the apparatus shown in **Diagram 1.**
- Stage II: Impure 1-bromobutane is extracted from the reaction mixture and transferred to the round bottomed flask in the apparatus shown in **Diagram 2.**
- Stage III: A sample of pure 1-bromobutane is obtained using the apparatus shown in **Diagram 2.** The sample is weighed and the yield calculated.

(a) Give the names of the practical techniques carried out in the apparatus shown in Diagrams 1 and 2.

Diagram 1

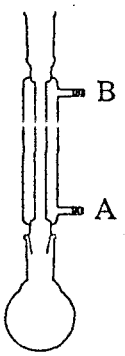

Diagram 2

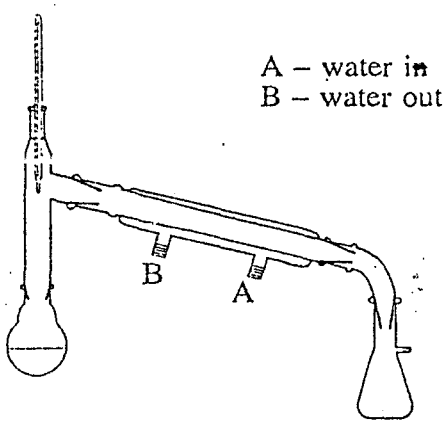

Diagram 1: .....

Diagram 2: .....

(2)

(b) (i) Explain why, in Stage I, the reactants are heated for such a long time.

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(1)

27

(ii) Explain the purpose and arrangement of the condenser in **Diagram 1**.

Leave blank

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(2)

(c) Briefly describe how you would use the apparatus shown in **Diagram 2** to give a sample of pure 1-bromobutane.

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(3)

(d) A student preparing 1-bromobutane by this method calculated that the maximum yield in this preparation was 7.2 g. His actual yield was 3.1 g.

(i) Calculate the percentage yield.

(2)

(ii) Suggest **two** reasons why the actual yield was much lower than the maximum yield.

Reason 1: .....

.....

Reason 2: .....

.....

(2)

Q3

(Total 12 marks)

28

4. (a) In an experiment to standardise an aqueous solution of sodium hydroxide 0.25 g of solid sulphamic acid, NH_2SO_3H, was dissolved in distilled water in a conical flask. When the aqueous sodium hydroxide was run into the flask from a burette 23.45 cm^3 was required to exactly react with the sulphamic acid solution. The equation for the reaction is:

Leave blank

$$NH_2SO_3H(aq) + NaOH(aq) \longrightarrow NH_2SO_3Na(aq) + H_2O(l)$$

(i) Calculate the amount (number of moles) of sulphamic acid in 0.25 g. $M_r(NH_2SO_3H) = 97.0$.

(1)

(ii) State the amount (number of moles) of sodium hydroxide in 23.45 cm^3 of solution and hence calculate the concentration of the solution in mol dm^{-3}.

(3)

(b) The balance used to weigh the sulphamic acid is accurate to ± 0.01 g. Calculate the percentage error in the mass of the sulphamic acid weighed.

(1)

29

(c) An alternative method to that described in (a) involves making an aqueous solution of sulphamic acid of **accurately known concentration.**

Leave blank

Describe a procedure by which you would prepare 250 cm^3 of aqueous sulphamic acid of accurately known concentration. Assume that you are provided with a weighing bottle containing between 2.40 g and 2.50 g of sulphamic acid and that this is a suitable mass to use.
In your answer give full practical details including the name of each piece of apparatus used, how each would be prepared for the procedure and how you would calculate the concentration (in mol dm^{-3}) of the sulphamic acid solution. State, with a reason, one appropriate safety precaution that should be taken.

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(8)

Q4

(Total 13 marks)

TOTAL FOR PAPER: 50 MARKS

END

30