Paper Reference(s)

6243/P.02

Edexcel GCS

Chemistry

Advanced Subsidiary

Unit Test C3B

Tuesday 18 January 2005 – Morning

Time: 1 hour

Materials required for examination
Nil

Item included with question paper
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, surname and initials, the paper reference and your signature.

Answer ALL the questions in the spaces provided in this question paper.

Calculators may be used.

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 various parts of questions are shown in round brackets: e.g. (2).

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 and orderly presentation in your answers.

Edexcel
Success through qualifications

Answer ALL questions in the spaces provided.

Leave blank

1. (a) A white solid, **A**, gives a yellow colour in a flame test.

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

Identify **A** and **B** by giving their names or formulae.

A .....

B .....

(2)

(b) When a white solid, **C**, is warmed with aqueous sodium hydroxide, a gas, **D**, is evolved which turns damp red litmus paper blue.

When dilute nitric acid followed by aqueous silver nitrate is added to an aqueous solution of **C**, a precipitate, **E**, is formed.

E does not dissolve in dilute aqueous ammonia, but does dissolve in concentrated aqueous ammonia.

(i) Identify **C** and **D** by giving their names or formulae.

C .....

D .....

(2)

(ii) State the colour of the precipitate **E**.

.....

(1)

(c) An organic compound, **F**, has two carbon atoms and one functional group in its molecule.

Leave blank

When phosphorus pentachloride is added to **F**, a gas, **G**, is evolved, which forms steamy fumes in moist air.

When **F** is warmed with aqueous potassium dichromate(VI) and dilute sulphuric acid, a colour change occurs as **F** is oxidised.

(i) Identify **F** and **G** by giving their names or formulae.

F .....

G .....

(2)

(ii) Describe the colour change that is seen when **F** is warmed with aqueous potassium dichromate(VI) and dilute sulphuric acid.

.....

(1)

(d) A hydrocarbon, **H**, has three carbon atoms and one functional group in its molecule.

When **H** is shaken with aqueous bromine, a reaction, accompanied by a colour change, occurs.

(i) Identify **H** by giving its name or formula.

.....

(1)

(ii) State the colour change that is seen when **H** reacts with aqueous bromine.

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

(1)

(Total 10 marks)

2. (a) (i) Describe how you would make up exactly 250 cm^3 of aqueous sodium carbonate, of accurately known concentration, from solid anhydrous sodium carbonate, Na_2CO_3.

Leave blank

You may assume that you are given a weighing bottle containing an appropriate amount of sodium carbonate, but that you still need to find the mass of sodium carbonate by weighing.

You do **not** need to include details of calculating the concentration in your answer.

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(6)

(ii) Calculate the concentration, in mol dm^{-3}, of a solution containing 1.28 g of anhydrous sodium carbonate, Na_2CO_3, in 250 cm^3 of solution.

(3)

(b) In a series of titrations, hydrochloric acid was added, from a burette, to 25.0 cm^3 portions of the sodium carbonate solution pipetted into conical flasks. Methyl orange was added as the indicator.

Leave blank

The burette readings are shown in the table below.

	1	2	3
Burette reading at end/cm^3	24.80	48.90	24.40
Burette reading at start/cm^3	0.00	24.80	0.00
Titre/cm^3	24.80	24.10	24.40

Number of titrations used to calculate the mean (average) titre: 1, 2 and 3

Mean titre = 24.43 cm^3 of hydrochloric acid

(i) Give the colour change that would be observed at the end point.

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

(1)

(ii) The student carrying out the titrations was criticised by the teacher for not carrying out at least one more titration.

Suggest a reason why the teacher's criticism was justified.

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.....

(1)

(c) Using the mean titre given and your answer to (a) (ii), calculate the concentration of the hydrochloric acid in mol dm^{-3}. The equation for the reaction in the titration is:

Leave blank

$$Na_2CO_3(s) + 2HCl(aq) \longrightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$$

(2)

(d) Before titration 2, the student rinsed the pipette with water and then immediately used it to transfer sodium carbonate solution to the conical flask for the titration.

If 0.5 cm^3 of water was present in the pipette, calculate the percentage error this would cause in the volume of hydrochloric acid needed in this titration.

(1)

(Total 14 marks)

3. In an experiment to find the enthalpy of neutralisation of a monobasic acid, **HX**, with an alkali, the following procedure was followed:

Leave blank

Step I: 25.0 cm^3 of 1.00 mol dm^{-3} dilute aqueous acid, **HX**, was measured into a polystyrene cup.

Step II: A 0–100 °C thermometer was placed in the acid. The temperature of the acid was immediately read and recorded.

Step III: 5.00 cm^3 portions of aqueous sodium hydroxide were added to the acid from a burette. After each addition, the temperature of the solution was read and recorded. The thermometer was removed and rinsed with water between each addition. A total of 50.0 cm^3 of aqueous sodium hydroxide was added.

(a) Suggest ONE change that could be made at Step II and ONE change that could be made at Step III to improve the accuracy of the experiment.

Step II .....

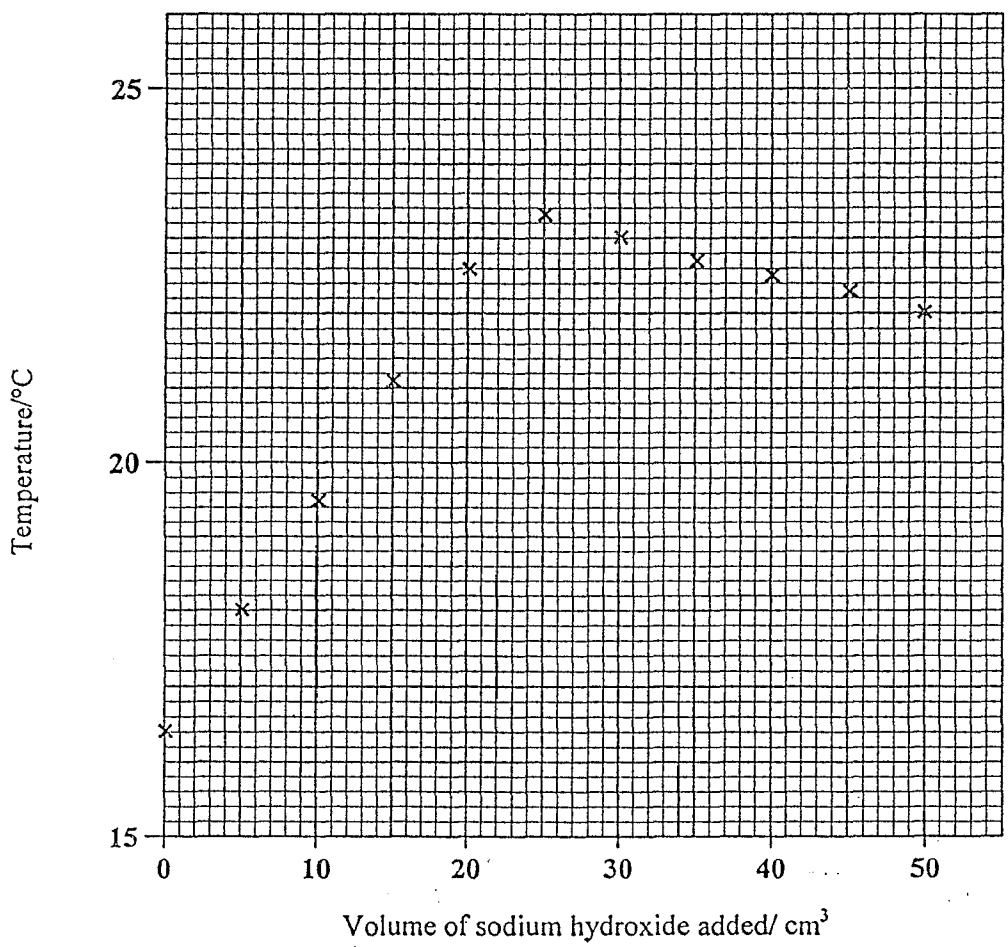
.....

Step III .....

.....

(2)

(b) The readings of temperature and volume are plotted on the grid. Draw two separate straight lines of best fit, extending the two lines so that they intersect.



(2)

(c) From the graph, read off the maximum temperature rise, ΔT, and the volume of aqueous sodium hydroxide added at neutralisation, V_N.

Leave blank

ΔT = ... °C V_N = ... cm^3

(2)

(d) **(i)** Use the formula below to calculate the heat evolved in the neutralisation.

$$\text{Heat evolved} = \frac{(V_N + 25) \times \Delta T \times 4.18}{1000} \text{ kJ}$$

(1)

(ii) Given that the amount (moles) of acid neutralised was 0.025 mol, calculate the enthalpy of neutralisation, ΔH_{neut}, in units of kJ mol^{-1}.

ΔH_{neut} ..... kJ mol^{-1}

(2)

(Total 9 marks)

4. 1-bromobutane can be prepared by the reaction of hydrogen bromide with butan-1-ol.

Leave blank

$$C_4H_9OH + HBr \longrightarrow C_4H_9Br + H_2O$$

Sodium bromide and sulphuric acid are used to generate the hydrogen bromide in the reaction flask.

The stages in the preparation are listed below.

- Mix sodium bromide, 50% sulphuric acid and butan-1-ol, then heat the mixture under reflux for about 30 minutes.
- Rearrange the apparatus for distillation and distil off the impure 1-bromobutane.
- Transfer the impure 1-bromobutane to a separating funnel so that the 1–bromobutane may be separated from the aqueous layer and then washed.
- Add anhydrous calcium chloride to the 1-bromobutane and leave to stand. When the liquid becomes clear, filter off the calcium chloride.
- Carry out a final distillation to obtain pure 1-bromobutane.

Information on 1-bromobutane, C_4H_9Br

Density 1.3 g cm^{-3}
Boiling temperature 102 °C
Harmful by skin absorption
Immiscible with water.

(a) (i) Calculate the maximum mass of 1-bromobutane that may be prepared from 4.0 g of butan-1-ol if all the other reagents are in excess.
[Molar masses: butan-1-ol = 74 g mol^{-1}, 1-bromobutane = 137 g mol^{-1}]

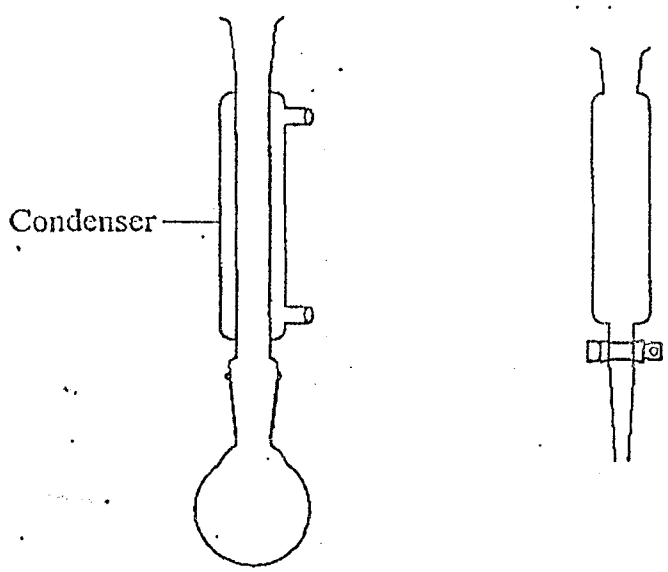
(1)

(ii) In a preparation, 5.9 g of 1–bromobutane is obtained from 4.0 g of butan–1–ol. Calculate the percentage yield.

(1)

(b) The diagrams below show the reflux apparatus and the separating funnel used in the preparation.

Leave blank



(i) Explain the purpose of the vertical condenser in the reflux apparatus.

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.....

.....

(2)

(ii) On the diagram of the separating funnel, draw and label two layers to show 1-bromobutane and water during the washing stage.

(1)

(iii) What is the purpose of adding anhydrous calcium chloride to the 1–bromobutane?

.....

(1)

(iv) Draw a labelled diagram of the distillation apparatus that is used to obtain pure 1-bromobutane.

Leave blank

(4)

(c) Give ONE safety precaution (apart from wearing eye protection and a laboratory coat) that should be taken during the preparation. Give a reason for your choice.

.....

.....

(1)

(Total 11 marks)

5. The table below states the gaseous products, if any, obtained when four solid compounds are heated. *Leave blank*

Solid compound	Gaseous products on heating compound
Calcium nitrate	Nitrogen dioxide, oxygen
Sodium nitrate	Oxygen
Sodium hydrogencarbonate	Carbon dioxide, water vapour
Sodium carbonate	No gas evolved

Plan an experiment, the results of which will allow you to identify the four compounds, using the information given in the table.

The four compounds are supplied to you in unlabelled test tubes.

You are allowed the use of apparatus for heating the compounds and materials for testing the gases evolved.

Describe the tests you will carry out and the observations you will make to identify the compounds.

Your plan must follow a logical order, identifying the compounds III turn.

Leave blank

(Total 6 marks)

TOTAL FOR PAPER: 50 MARKS

END