Paper Reference(s)

6243/P.02

Edexcel GCS

Chemistry

Advanced Subsidiary

Unit Test C3B

Wednesday 8 June 2005 – Morning

Time: 1 hour

Materials required for examination	Item included with question paper
Nil	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) Salt **D** contains two cations and one anion.

(i) Complete the table, giving tests and observations to show that ammonium ions, NH_4^+, and potassium ions, K^+, are present in **D**.

Test	Observation	Inference
		NH_4^+ ions
		K^+ ions

(4)

(ii) Complete the inference statements in the table below.

Test	Observation	Inference
Aqueous barium chloride is added to a solution of **D**. Dilute hydrochloric acid is then added.	White precipitate is formed which does not dissolve in dilute hydrochloric acid.	The precipitate is ..... Therefore the anion in **D** is .....

(2)

(b) A solution of potassium chloride is contaminated with either potassium bromide or potassium iodide.

Leave blank

Describe how you would decide whether potassium bromide or potassium iodide is present. Your description should include:

- the reagents you would use
- what you would do
- the observations you would make to identify both possible contaminants.

(4)

(Total 10 marks)

2. In an experiment to find the enthalpy change for the reaction

$$Zn(s) + Cu^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Cu(s)$$

a student was given the following list of instructions:

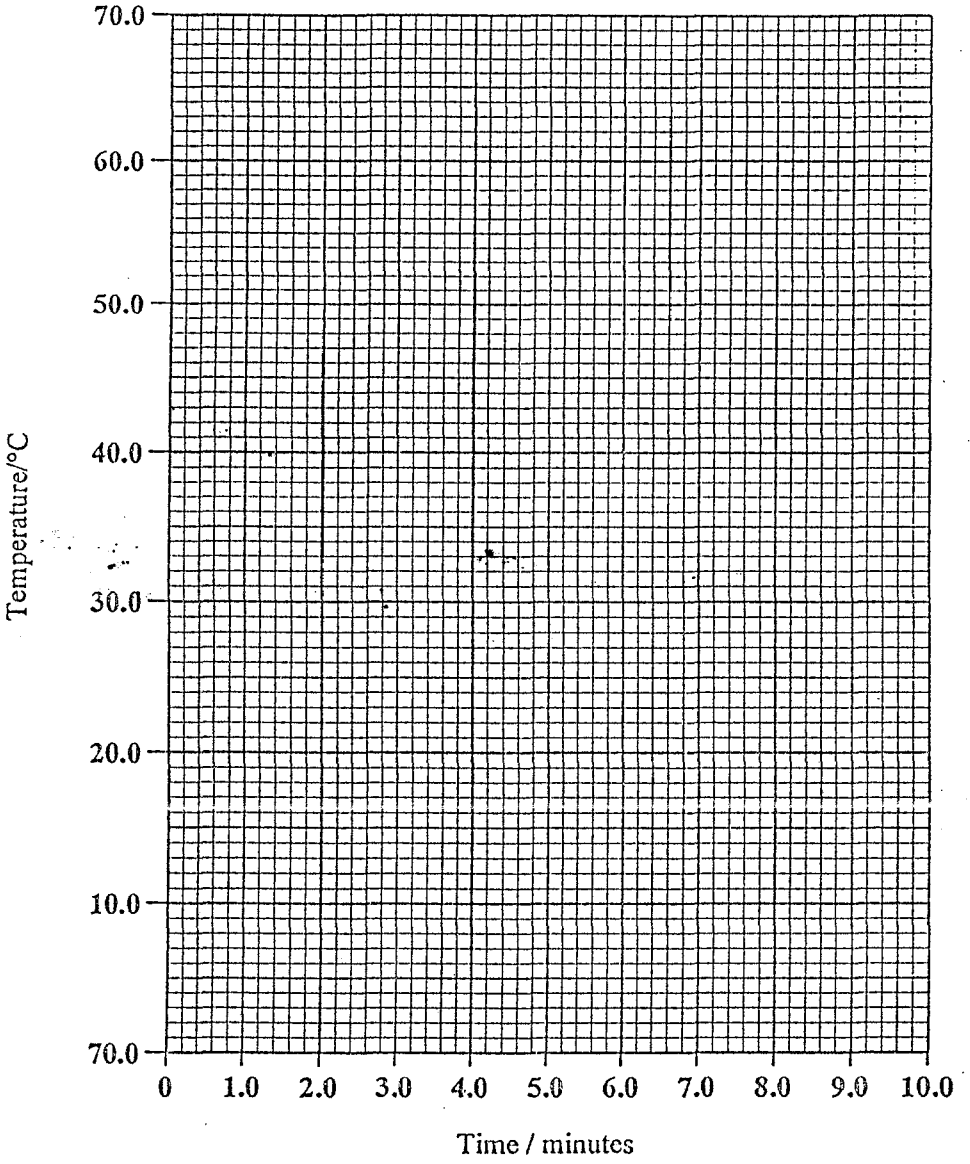
- Weigh out 5.0 g of zinc powder into a weighing bottle
- use a measuring cylinder to transfer 50 cm^3 of 1.0 mol dm^{-3} aqueous copper(II) sulphate into a polystyrene cup, firmly held in a 250 cm^3 beaker
- stir the solution with the thermometer and record the temperature to the nearest 0.5 °C
- continue to stir the solution, recording its temperature every minute
- at exactly 3.5 minutes, add the zinc powder to the aqueous copper(II) sulphate, stirring continuously
- record the temperature of the solution every minute from 4.0 to 9.0 minutes.

The temperature readings obtained are shown in the table below.

Time/min	0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
Temperature/°C	20.0	20.0	20.0	20.0	63.0	60.5	59.0	57.0	55.5	53.0

(a) (i) Plot a graph of temperature against time on the grid below.

Leave blank



(2)

(ii) Use the graph to calculate the maximum temperature change, ΔT Show clearly on the graph how you obtained your answer.

ΔT = ...°C

(2)

(iii) Give ONE reason why a series of temperature readings is obtained instead of just the starting and maximum temperatures.

.....

.....

(1)

(b) (i) Calculate the heat change, in joules.

Leave blank

The specific heat capacity of the solution is 4.18 J g^{-1} $°C^{-1}$.

(1)

(ii) What assumption have you made about the solution in your calculation in (i)?

.....

.....

(1)

(iii) Calculate the amount (moles) of copper(II) sulphate, $CuSO_4$, in 50 cm^3 of a 1.0 mol dm^{-3} solution.

(1)

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

(2)

(c) Suggest TWO improvements that could be made to the experimental procedure.

Leave blank

Give a reason for each.

Improvement 1 .....

.....

.....

Reason .....

.....

.....

Improvement 2 .....

.....

.....

Reason .....

.....

.....

(4)

(Total 14 marks)

3. 2-chloro-2-methy(propane, $(CH_3)_3CCl$, can be prepared from 2-methylpropan-2-ol, $(CH_3)_3COH$, by reaction with concentrated hydrochloric acid, HCl. *Leave blank*

$$(CH_3)_3COH + HCl \longrightarrow (CH_3)_3CCl + H_2O$$

Some useful data are given in the following table.

Substance	Boiling temperature /°C	Density /g cm^{-3}
2-methylpropan-2-ol	83.0	0.79
2-chloro-2-methylpropane	51.0	0.84
water	100	1.00

In an experiment, 8.00 g of 2-methylpropan-2-ol was shaken with 20 cm^3 of concentrated hydrochloric acid in a separating funnel. After about 15 minutes, the product formed as a separate layer.

(a) Use the data to suggest which layer in the separating funnel contained the organic product.

.....

.....

.....

(2)

(b) After separation, the organic layer was shaken with sodium hydrogencarbonate solution. Fizzing was observed.

(i) Identify the gas that was given off.

.....

(1)

(ii) Give the **formula** of the ion, present in solution, that reacted with the hydrogencarbonate ion to form the gas.

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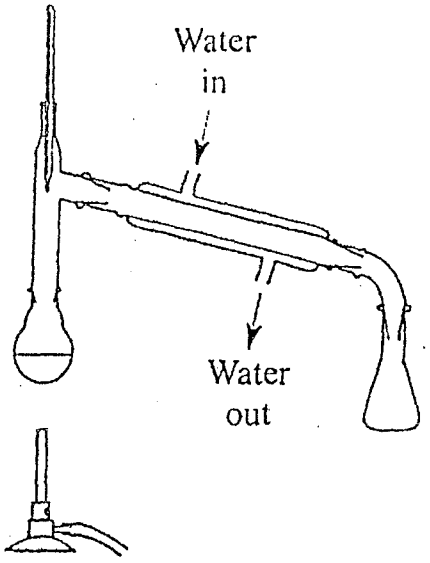
(1)

(c) After washing and drying the organic product, a student set up the following apparatus for distillation. It contains three mistakes, which were identified by a teacher before heating began.

Leave blank



(i) Identify the THREE mistakes in the set-up shown.

Mistake 1 .....

.....

.....

Mistake 2 .....

.....

.....

Mistake 3 .....

.....

.....

(3)

(ii) State the temperature at which the pure organic product would distil over.

.....

(1)

(d) 6.99 g of pure 2-chloro-2-methylpropane was produced in the experiment.

Leave blank

(i) Calculate the maximum mass of 2-chloro-2-methyl propane (molar mass = 92.5 g mol^{-1}) that could be formed from 8.00 g of 2-methylpropan-2-ol (molar mass = 74.0 g mol^{-1})

(2)

(ii) Calculate the percentage yield of 2-chloro-2-methylpropane in this experiment.

(1)

(e) Describe a chemical test that you would do to show that the final sample of 2-chloro-2-methylpropane did not contain any 2-methylpropan-2-ol.

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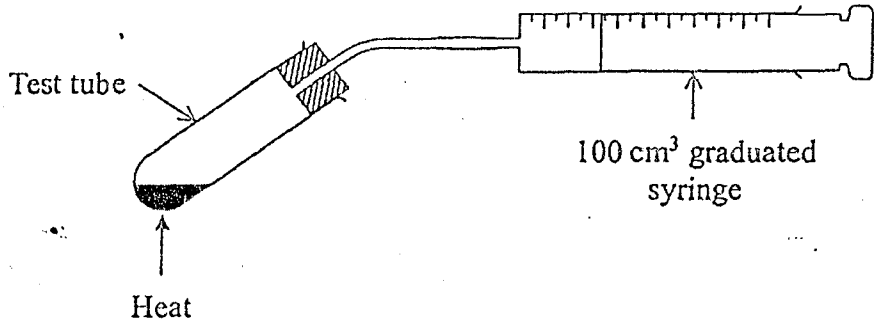
(2)

(Total 13 marks)

4. A student investigated the ease with which Group 2 metal carbonates thermally decompose when heated with a Bunsen burner. *Leave blank*

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

The student heated each carbonate separately in a test tube. The volume of gas collected in a gas syringe was measured after two minutes.



(a) Each test tube must be heated directly by a Bunsen flame in an identical manner. Suggest how this can best be achieved.

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.....

(2)

(b) In each experiment, the student used the same number of moles of metal carbonate. *Leave blank*

The mass of magnesium carbonate, $MgCO_3$, heated was 0.21 g.

Calculate the mass of barium carbonate, $BaCO_3$, that should be used for a valid comparison.

(3)

(c) (i) Calculate the maximum volume of carbon dioxide that would be produced by the complete decomposition of 0.21 g of magnesium carbonate.
[1 mol of gas occupies 24000 cm^3 under the conditions of the experiment.]

(2)

(ii) The balance used to weigh the magnesium carbonate is accurate to ±0.01 g.
Calculate the percentage error in the mass of the magnesium carbonate weighed.

(1)

Leave blank

(d) The following results were obtained after heating each sample for two minutes.

Metal carbonate in the test tube	Volume of gas produced/cm^3
None	9
$MgCO_3$	20
$CaCO_3$	13
$SrCO_3$	11
$BaCO_3$	9

(i) Why was a test tube containing no metal carbonate heated?

.....

.....

.....

(1)

(ii) Describe a chemical test that would be used to confirm the identity of the gas produced.

Test .....

Result .....

(2)

(iii) Use the results in the table to describe the trend in thermal stability of the Group 2 metal carbonates.

.....

.....

.....

(2)

(Total 13 marks)

TOTAL FOR PAPER: 50 MARKS

END