OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced Subsidiary GCE

CHEMISTRY 2813/03/TEST

Practical Examination 1 (Part B – Practical Test)

Thursday **19 MAY 2005** Morning 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Data Sheet for Chemistry
Candidate's Plan (Part A of the Practical Examination)
Scientific calculator

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces provided on the question paper.
- Read instructions and questions carefully.

INFORMATION FOR CANDIDATES

- In this part of the Practical Test, you will be assessed on the Experimental and Investigative Skills:
  Skill I Implementing
  Skill A Analysing evidence and drawing conclusions
  Skill E Evaluating evidence and procedures
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- You will be awarded marks for the quality of written communication where this is indicated.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
Planning	**16**	
Implementing & Analysing	**30**	
Evaluating	**14**	
TOTAL	**60**	

This question paper consists of 10 printed pages and 2 blank pages.

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Answer **all** the parts.

Introduction

In these experiments, you will investigate some compounds of Group 2 metals.

Part 1 Heating hydrated magnesium sulphate crystals
Skill I (Implementing) **[7 marks]**

Record all your readings clearly in the space at the top of page 3.

Hydrated salts contain water of crystallisation.
One example is hydrated copper(II) sulphate, $CuSO_4.5H_2O$, that contains five moles of water of crystallisation in one mole of $CuSO_4.5H_2O$.
When many hydrated compounds are heated, they lose their water of crystallisation. The residue after heating is an **anhydrous** compound, containing no water of crystallisation.

In this experiment, you will heat hydrated magnesium sulphate until it becomes anhydrous.

Weigh an empty crucible with a lid.
*Do **not** 'tare' the balance when you do this weighing.*

Transfer all your sample of hydrated magnesium sulphate to the crucible and reweigh it, together with the lid.

Support the crucible on a tripod using a pipe-clay triangle.
Heat the crucible **gently**, with the lid on, for about **one** minute.
Then remove the lid and heat strongly for a further **four** minutes.
If the crucible cracks while being heated, ask your teacher for another one.

Replace the lid and leave the crucible to cool for **at least five** minutes.
While you are waiting for the crucible to cool, carry out tests described in Part 3 on page 6.

When the crucible is cool, re-weigh it with the residue and the lid.

Remove the lid. Heat the crucible and its contents again strongly for **two** minutes.
Replace the lid. Cool the crucible for at least **five** minutes.
Then re-weigh the crucible, lid and the contents.

Carry on with the experiments described in Parts 3 and 4 while you are waiting for the crucible to cool.

Use the space below to record all your readings.

Safety

When you are not using your Bunsen burner, how should you adjust the flame? Explain why you should do this.

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Part 2 Calculation of the number of moles of water of crystallisation in one mole of hydrated magnesium sulphate
Skill A (Analysing) **[6 marks]**

Look up relative atomic mass values in the *Data Sheet*.
Use your readings from Part 1 when you carry out the calculations.

(a) Calculate the mass of anhydrous magnesium sulphate, $MgSO_4$, left as the residue after heating.

answer = ... g

(b) Calculate how many moles of anhydrous $MgSO_4$ were produced.

answer = ... mol

(c) Calculate the mass of water of crystallisation lost when hydrated magnesium sulphate was heated.

answer = ... g

(d) Deduce how many moles of water of crystallisation were lost.

answer = ... mol

(e) From the ratio of your answers to **(b)** and **(d)**, deduce the number of moles of water of crystallisation in one mole of hydrated magnesium sulphate.
Express your answer the nearest whole number.

answer = ... mol

Part 3 Some experiments with marble chips
Skills I and A (Implementing and Analysing) **[11 marks]**

Marble chips contain calcium carbonate.
You will investigate how marble chips react with three acids of equal concentration.

(a) Pour about a 3 cm depth of the dilute nitric acid provided into a boiling tube. **Corrosive** 

Pour about a 3 cm depth of dilute hydrochloric acid and dilute sulphuric acid, separately, into two more boiling tubes. **Both acids are irritant** 

Choose three pieces of marble chip that are of approximately the same size.

Quickly, add **one** marble chip to **each** of the acids in the boiling tubes.
Observe the tubes for about 2 minutes.

Record the similarities and differences between the three reactions in the space below.
Tabulate your observations.

(b) Complete and balance the equation below for the reaction of dilute hydrochloric acid with calcium carbonate.

$$HCl + CaCO_3 \rightarrow \text{.....} + \text{.....} + \text{.....}$$

(c) When a marble chip reacts with **one** of the three acids you have tested, an insoluble surface layer soon forms around the chip.

Suggest which acid causes this insoluble layer to be formed. Explain your answer.

name of acid .....

reason .....

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(d) Use ideas about collisions to explain how this insoluble layer affects the rate of reaction.

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(e) Identify the chemical that makes up the insoluble layer around the marble chip.

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Part 4 Some experiments with solution Z
Skills I and A (Implementing and Analysing) **[6 marks]**

You will attempt to identify the unknown solution **Z** by carrying out two tests.

(a) Pour about a 1 cm depth of solution **Z** into a test tube.
Test the solution with the indicator paper provided.
Record both your observation and your deduction.

name of indicator used .....

observation made .....

deduction about solution **Z** .....

(b) Read all of the instructions for this test before you begin.

Pour about a 5 cm depth of solution **Z** into a test tube.
Put a spatula measure (about 0.5 g) of powdered calcium carbonate into another test tube. Then add about 5 cm^3 of dilute hydrochloric acid to the calcium carbonate, using a measuring cylinder.
Immediately fit the test tube with a bung and delivery tube and bubble the gas produced into solution **Z**.

State what you observed in the tube containing solution **Z**.

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(c) From the results of tests **(a)** and **(b)**, deduce the name of solution **Z**.

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Explain the observations made in tests **(a)** and **(b)**.

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Part 5 Skill E (Evaluating) **[14 marks]**

(a), **(b)** and **(c)** each carry roughly equal marks.

(a) (i) With reference to the experiment in Part 1, explain why

the crucible was initially heated **with the lid on**;

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the crucible was cooled **with the lid on**.

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(ii) Why was the crucible cooled before weighing it?

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(iii) Explain why the crucible was re-heated for a further two minutes.

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(b) A student attempted to determine the number of moles of water of crystallisation in one mole of hydrated magnesium sulphate by a similar method to the one you used in Part 1.
He heated 0.24 g of hydrated magnesium sulphate.

(i) The student used a smaller mass of solid than you did in Part 1.
Discuss **one** advantage and **one** disadvantage of using a smaller mass of solid for the experiment.

advantage .....

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disadvantage .....

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(ii) Which affects the overall accuracy the most, the advantage or the disadvantage you have given in **(i)**?

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(c) In the experiments you carried out in Part 3, the hydrochloric, sulphuric and nitric acids provided were of concentration 1.0 mol dm^{-3}.

(i) Explain why it is desirable that concentrations of hydrochloric and nitric acids should be the same.

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(ii) Use ideas about ions to suggest why this may **not** be a suitable concentration for the sulphuric acid in comparison to the other acids.

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(d) In the experiment to compare the reactivity of acids in Part 3(a) state **three** ways of improving the accuracy of the test.

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END OF QUESTION PAPER

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