THIS IS A LEGACY SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

CHEMISTRY

2813/03/TEST

Practical Examination 1 (Part B – Practical Test)

Candidates answer on the question paper

OCR Supplied Materials:
- *Data Sheet for Chemistry* (inserted)

Other Materials Required:
- Candidate's Plan (Part A of the Practical Examination)
- Scientific Calculator

Monday 11 May 2009
Afternoon

Duration: 1 hour 30 minutes

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- 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 a scientific calculator.
- You are advised to show all the steps in any calculations.
- You may refer to your Plan produced for Part A.
- You will be awarded marks for the quality of written communication where this is indicated.
- A copy of the *Data Sheet for Chemistry* is provided as an insert with this question paper.
- This document consists of **12** pages. Any blank pages are indicated.

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

Answer **all** the parts.

Introduction

You will identify a hydrated salt, $MCl_2.2H_2O$, where **M** is the symbol of the unknown metal. You will heat the salt to remove the water of crystallisation.
You will also carry out some test-tube reactions of this salt.

You are supplied with:

- Approximately 2 g of the hydrated salt, $MCl_2.2H_2O$, in each of two weighing bottles. **Toxic**

- An aqueous solution of the salt, MCl_2. **Harmful**

Part 1 Action of heat on the hydrated salt, $MCl_2.2H_2O$
Skill I (Implementing) **[12 marks]**

Record all your readings in a table on page 3.

You will carry out the following experiment **twice**.

Weigh one of the empty crucibles.
*Do **not** 'tare' the balance after you do this weighing.*

Add all of the $MCl_2.2H_2O$, from one of the weighing bottles provided, into the weighed crucible.
Weigh the crucible with $MCl_2.2H_2O$.
Calculate the mass of $MCl_2.2H_2O$ used.

Using a pipe-clay triangle, support the crucible and contents on a tripod.
Heat the crucible and contents gently for about **one** minute.
Then heat it strongly for a further **three** minutes.
If the crucible cracks while being heated, ask your teacher for another one.

While you are heating the crucible, begin to read through the rest of this paper.

Leave the crucible and residue to cool for at least ten minutes.
While you are waiting for the crucible and residue to cool, carry out the tests described in Part 3 on pages 6 and 7.

When the crucible and residue are cool, weigh the crucible and residue.
Calculate the mass of residue obtained.

Repeat the experiment using the other crucible, following exactly the same procedure as above.
This time, while the crucible and residue are cooling, start Part 4 (a), (b) and (c) on page 8.

Readings and calculations

Use the space below to record **all** of your weighings for both experiments (tabulated).

Calculation of mean masses

Calculate the mean masses listed below.

Mean mass of hydrated salt, $MCl_2.2H_2O$, used.

answer = ... g

Mean mass of residue, anhydrous MCl_2, obtained.

answer = ... g

Mean mass of water of crystallisation removed.

answer = ... g

Safety

Why do the samples of MCl_2 and $MCl_2.2H_2O$ provided show different hazard symbols?

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Part 2 Identification of metal M
(Skill A – Analysing) **[10 marks]**

Use the *Data Sheet for Chemistry* for any data you require.
Your working must be shown clearly.
Give your answers to **three** significant figures.

(a) Calculate the mean number of moles of H_2O removed when your samples of $MCl_2.2H_2O$ were heated.

answer = ... mol

(b) Complete the equation for the decomposition of $MCl_2.2H_2O$ while being heated.
Include state symbols.

$$MCl_2.2H_2O(\quad) \rightarrow \text{.....}(\quad) + \text{.....}(\quad)$$

(c) Use your answers from **(a)** and **(b)** to deduce the mean number of moles of anhydrous MCl_2 formed in the reaction.

answer = ... mol

(d) Using your answer to **(c)** and your results on page 3, calculate the relative formula mass of anhydrous MCl_2.

answer = ...

(e) Calculate the relative atomic mass of metal **M**.

answer = ...

(f) **M** is **not** a transition metal and forms a salt with formula MCl_2.
Which group in the Periodic Table is likely to contain **M**?
Suggest a possible identity for **M**.
Justify your answer.

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Part 3 Test-tube reactions on aqueous MCl_2
(Skills I + A: Implementing and Analysing) **[8 marks]**

In this **Part**, you will use the solution of MCl_2 provided, in three tests.

Three other solutions, in dropping bottles, are supplied.

- Aqueous silver nitrate, $AgNO_3$. **Irritant** 
- Dilute aqueous sulphuric acid, H_2SO_4. **Irritant** 
- Aqueous sodium carbonate, Na_2CO_3.

(a) Pour about a 1 cm depth of aqueous MCl_2 into a test-tube.
Add five drops of aqueous silver nitrate, $AgNO_3$.

(i) State the observation made.

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(ii) **Name** the product responsible for the observation made.

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(iii) Give the **ionic** equation for the reaction.

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(b) Pour about a 1 cm depth of aqueous MCl_2 into another test-tube.
Add about ten drops of aqueous sulphuric acid, H_2SO_4.

(i) State the observation made.

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(ii) The equation for the reaction is given below.
Add **state symbols** to the equation.

$$MCl_2(\quad) + H_2SO_4(\quad) \longrightarrow 2HCl(\quad) + MSO_4(\quad)$$

(iii) What property of MSO_4 is illustrated in this reaction?

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(c) Pour about a 1 cm depth of aqueous MCl_2 into another test-tube.
Add ten drops of aqueous sodium carbonate, Na_2CO_3.

(i) State the observation made.

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(ii) The reaction is the same **type** as the reactions taking place in **(a)** and **(b)**.
Predict the formula of the product causing the observation made in this reaction.

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(iii) Complete the equation for this reaction.

$$MCl_2 + Na_2CO_3 \rightarrow \text{.....} + \text{.....}$$

Now return to page 2 and continue with your experiment.

Part 4 Skill E (Evaluating) **[14 marks]**

(a) You carried out the procedure in **Part 1** without using crucible lids.
Use of a lid is normally recommended during this procedure.

Suggest **one** reason why using a lid might have increased the accuracy of the experiment.

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..... **[1]**

(b) Explain why the procedure in **Part 1** might have been improved by re-heating the crucible and residue.

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..... **[2]**

(c) A student suggested that the experiment would have been more accurate if the hydrated salt in **Part 1** had been heated with a **yellow** Bunsen flame.

Suggest **two** reasons why the student is **not** correct.

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..... **[2]**

(d) (i) Calculate the maximum percentage error in the mean mass of water of crystallisation lost in **Part 1**, caused by the accuracy tolerance of a balance.
Assume that the balance you used weighs to 0.01 g.
Show your working.

[3]

(ii) Suggest **two** ways in which you could modify the procedure to improve the accuracy.
Justify your answers. Do not repeat material from your answers to **(a)**, **(b)** and **(c)**.

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..... **[4]**

(e) Discuss the **reliability** of your experimental procedure in **Part 1**.
Justify your answer.

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..... **[1]**

(f) MCl_2 is an ionic compound.
Suggest why the relative atomic mass and identity of **M** could not have been determined by the method in **Part 1** if MCl_2 was covalent.

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..... **[1]**

END OF QUESTION PAPER

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