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Cambridge Pre-U

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
Cambridge International Level 3 Pre-U Certificate
Principal Subject

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

1784926876

CHEMISTRY **9791/04**

Paper 4 Practical **May/June 2012**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Give details of the practical session and laboratory where appropriate, in the boxes provided.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
You may lose marks if you do not show your working or if you do not use appropriate units.
A Data Booklet is provided.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Session
Laboratory

For Examiner's Use	
1	
2	
3	
Total	

This document consists of **7** printed pages and **1** blank page.

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1 **FA 1** is a Group 2 metal chloride dihydrate, $MCl_2.2H_2O$. By measuring the mass loss on forming the anhydrous salt the identity of *M* can be determined.

For Examiner's Use

(a) Method

Before starting any practical work, read through all the instructions and prepare a single table for your results in the space provided.

1. Weigh a clean dry crucible without a lid and record your reading.
2. Place in the crucible the entire sample of the salt, **FA 1**.
3. Reweigh the crucible and record your reading.
4. Support the crucible in the pipe-clay triangle on top of a tripod.
5. Heat the crucible **gently** for about 1 minute and then more strongly for a further 4 minutes.
6. Allow the crucible to cool.
   While the crucible is cooling you may wish to start another question.
7. As soon as the crucible is cool enough to handle, reweigh the crucible and its contents and record your reading.
8. Calculate and record the mass of the residue and the mass of water lost.

Results

I	
II	
III	
IV	

[4]

(b) Use your measurements to identify the Group 2 metal present in **FA 1**, $MCl_2.2H_2O$.
You must show your working.

[3]

(c) Starting with the same mass of **FA 1**, suggest how you could have modified the experiment to determine more accurately the mass of water lost.

.....

.....[1]

[Total: 8]

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2 **FA 2** is an anhydrous Group 1 metal chloride. By titrating a solution of **FA 2** with aqueous silver nitrate, the percentage by mass of chloride in the salt can be determined. The equation for the reaction is shown below.

For Examiner's Use

$$Ag^+(aq) + Cl^-(aq) \longrightarrow AgCl(s)$$

The following reagents are provided.

FA 2 is the Group 1 metal chloride
FA 3 is 0.0500 mol dm^{-3} silver nitrate
FA 4 is neutral chromate indicator (aqueous potassium chromate)

(a) Method

Before starting any practical work, read through all the instructions and prepare suitable tables for your results in the spaces provided.

Preparing the solution

1. Weigh the weighing bottle containing the metal chloride, **FA 2**, and record your reading.
2. Tip the contents of the weighing bottle into a 100 cm^3 beaker.
3. Reweigh the empty weighing bottle and record your reading.
4. Calculate and record the mass of **FA 2** added to the beaker.
5. Add distilled water to the beaker and stir until the metal chloride has dissolved.
6. Transfer the contents carefully into the 250 cm^3 volumetric flask.
7. Rinse the contents of the beaker with a little distilled water and add these washings to the volumetric flask.
8. Fill the volumetric flask to the line with distilled water. Stopper the flask and invert several times to ensure thorough mixing.

Results

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Titration

9. Fill a burette with silver nitrate solution, **FA 3**.
10. Use a pipette to transfer 25.00 cm^3 of the metal chloride solution into a conical flask.
11. Add 10 drops of the chromate indicator, **FA 4**, using a dropping pipette.
12. Run the solution from the burette into the conical flask until the precipitate takes on a permanent pink colour.
13. Repeat the titration as many times as you feel are necessary to obtain consistent results.
14. Record your results in a suitable form in the space below.

For Examiner's Use

I	
II	
III	
IV	
V	
VI	
VII	

Results

[7]

(b) From your titration results obtain a volume of **FA 3** to be used in the following calculations. Show clearly how you obtained this value.

25.00 cm^3 of the solution of **FA 2** required …… cm^3 of **FA 3**. [2]

(c) By performing the following calculations you will be able to work out the percentage by mass of chloride ions present in **FA 2**.
You must show your working.

(i) Calculate the amount, in mol, of silver nitrate present in the volume of **FA 3** calculated in **(b)**.

…… mol

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(ii) Calculate the amount, in mol, of chloride ions present in your weighed sample of **FA 2**.

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…… mol

(iii) Calculate the percentage by mass of chloride ions in **FA 2**.

I	
II	
III	
IV	
V	

the percentage by mass of chloride ions in **FA 2** = …… %
[5]

(d) A source of error in this experiment involves the burette readings.

(i) What is the uncertainty of each titre recorded in **(a)**? Explain your answer.

.....

.....[1]

(ii) Assuming that:
- your answer to **(d)(i)** is the error in the value you calculated in **(b)** and
- this is the only error in the experimental procedure,

calculate the minimum value for your percentage by mass of chloride ions in **FA 2**.

The minimum percentage by mass of chloride ions in **FA 2** is …… [1]

[Total: 16]

3 **(a)** **FA 5** is a solution containing three unknown **cations**. By choosing appropriate reagents you will be able to identify the cations that are present.

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Carry out tests to identify the three cations. Record your observations in the space below.

Where gases are released they should be identified by a test, **described in the appropriate place in your observations**.

If any solution is warmed a boiling tube MUST be used.

Results

I	
II	
III	
IV	
V	
VI	
VII	

The three cations in **FA 5** are ……, …… and …… [7]

(b) Solution **FA 5** contains either the sulfate or sulfite anion.

(i) State reagents that will allow you to determine which anion is present.

.....

.....[1]

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(ii) Use these reagents to test solution **FA 5**. Record your tests and observations in the space below and hence determine which anion is present.

For Examiner's Use

I	
II	
III	
IV	

The anion in **FA 5** is …… [3]

(c) (i) Carry out the following tests.

test	observations
To a 1 cm depth of **FA 5** in a boiling tube add 1 cm depth of hydrogen peroxide, then	
add to the mixture a 1 cm depth of aqueous sodium hydroxide. Stir the contents of the boiling tube carefully.	

[3]

(ii) Suggest an explanation for your observations.

.....

.....

.....

.....[2]

[Total: 16]

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