Cambridge Pre-U

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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CHEMISTRY **9791/04**

Paper 4 Practical **May/June 2010**

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.

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.

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

1 Epsom salts occur naturally and are a hydrated form of magnesium sulfate, $MgSO_4.xH_2O$. In the following experiment you will determine the value of x.
Read all of the following instructions before you start any experimental work.

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You are provided with the following:
FA 1 hydrated magnesium sulfate, $MgSO_4.xH_2O$

Method

1. Weigh a clean, dry crucible.
2. In the crucible place the entire sample of Epsom salts, **FA 1**.
3. Reweigh the crucible.
4. Place the crucible in a 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 for about 1 minute and then use a pair of tongs to place the crucible on a heat proof mat.
7. Leave the crucible to cool for approximately three minutes, then reweigh the crucible and its contents.
8. Repeat the cycle of heating and weighing, as described in steps 4 to 7, until consecutive recorded masses do not differ by more than 0.05 g.

(a) In a suitable table, record all masses.
Calculate the mass of the residue and the mass of the water lost. Record both of these masses in the table.

[8]

(b) From the measurements you have made, determine the value of x in the formula $MgSO_4.xH_2O$.

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Show your working.

.....[4]

(c) **(i)** State the uncertainty in the measurement of each mass in this experiment.

uncertainty = ± ..... g [1]

(ii) Calculate the percentage error in the mass of water that is lost.

Show your working.

.....[2]

(d) Suggest an improvement that a student might make to the experiment and explain why this would lead to the determination of a more accurate value of x.

.....

.....

.....[2]

[Total: 17]

2 **FA 2**, **FA 3**, **FA 4**, **FA 5** and **FA 6** contain a number of different ions. By making observations when each pair of solutions is mixed it is possible to determine which solution contains which ion. The following ions are present: H^+, CrO_4^{2-}, SO_4^{2-}, Pb^{2+}, Ba^{2+} and OH^-.

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(a) Complete the following table by recording your observations on mixing each pair of solutions.

	FA 3	**FA 4**	**FA 5**	**FA 6**
FA 2				
FA 3				
FA 4				
FA 5				

[8]

(b) From your observations, identify which of the solutions contain the following ions.

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ion	H^+	CrO_4^{2-}	SO_4^{2-}	Pb^{2+}	Ba^{2+}	OH^-
solution						

[6]

(c) **FA 6** is an aqueous solution of a nitrate. Explain how you would confirm the presence of the nitrate anion. **Do not carry out any experimental work**.

.....

.....

.....[2]

[Total: 16]

Before starting question 3, half-fill a 250 cm^3 beaker with water and heat it with a Bunsen burner to between 50 °C and 70 °C. You will use this as a hot water-bath in this question. Turn off the Bunsen burner.

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3 **FA 7**, **FA 8** and **FA 9** each contain a single compound which could be butan-1-ol, butanal or butanone. By reacting each of the compounds first with acidified potassium dichromate(VI) and then with Tollens' reagent you should identify each of the three samples.

Tollens' reagent must be prepared immediately before use.

Method

Test with acidified potassium dichromate(VI)

1. Into separate test-tubes, to a depth of approximately 1 cm, pour **FA 7**, **FA 8** and **FA 9**.
2. Add approximately 1 cm depth of dilute sulfuric acid to each test-tube.
3. Add a few drops of aqueous potassium dichromate(VI).
4. If no initial reaction is seen, warm the test-tube in the hot water-bath.

Preparation of Tollens' reagent

5. Pour aqueous silver nitrate into a boiling tube to a depth of approximately 2 cm.
6. Add approximately 0.5 cm depth of aqueous sodium hydroxide.
7. Add aqueous ammonia a little at a time with continuous shaking until the brown precipitate **just** dissolves. Be careful not to add an excess of aqueous ammonia.

Test with Tollens' reagent

8. Into separate, clean, dry test-tubes, to a depth of approximately 1 cm, pour **FA 7**, **FA 8** and **FA 9**.
9. Add a few drops of Tollens' reagent.
10. If no initial reaction is seen, warm the test-tube in the hot water-bath.

(a) Record all your observations in a single table.

[4]

(b) Identify each sample. In each case explain the observations leading to your conclusion.

For Examiner's Use

FA ……. contains butan-1-ol.

explanation .....

.....[1]

FA ……. contains butanal.

explanation .....

.....[1]

FA ..…… contains butanone.

explanation .....

.....[1]

[Total: 7]

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