Centre Number | Candidate Number

Candidate Name _____

CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Advanced Level

CHEMISTRY 9701/5

PAPER 5 Practical Test

OCTOBER/NOVEMBER SESSION 2002

1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
As listed in Instructions to Supervisors

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

You are advised to show all working in calculations.

Use of a Data Booklet is unnecessary.

FOR EXAMINER'S USE	
1	
2	
TOTAL	

This question paper consists of 5 printed pages and 3 blank pages.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

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For Examiner's Use

1 You are to investigate the reaction between substance **X**, iodine and hydrogen ions.

FA 1 is 1.00 mol dm^{-3} sulphuric acid.
FA 2 is an aqueous solution of substance **X**.
FA 3 is 0.0038 mol dm^{-3} iodine, I_2.

Fill a burette with solution **FA 3**.

(a) Using the measuring cylinder provided, measure out 20.0 cm^3 of **FA 1** and 20.0 cm^3 of **FA 2**, as shown in column 1 of *Table 1.1*, into a 250 cm^3 conical flask. It is not necessary to rinse the measuring cylinder between solutions.
Measure out 4.0 cm^3 of **FA 3** from the burette into a test-tube.
Start the reaction by tipping the **FA 3** from the test-tube into the conical flask. Start the stop-clock with one hand and swirl the contents of the flask with the other. Place the flask on a white tile and stop the clock as soon as the colour disappears.
Record the time (in seconds, to the nearest second) in *Table 1.1*.
Repeat the experiment using the different volumes of **FA 1**, **FA 2** and **FA 3** as shown in *Table 1.1*. Where water is required, use the measuring cylinder to add the water to the other solutions in the conical flask.
Experiment 2 is the same as experiment 1 to give you the opportunity of practising the technique.

The 'rate of reaction' can be calculated by using the relationship:

$$\text{'rate'} = \frac{\text{volume of } \mathbf{FA\ 3} \text{ in } cm^3}{\text{time in seconds for colour to disappear}}$$

Table 1.1

	1	2	3	4
volume of **FA 1** / cm^3	20.0	20.0	10.0	20.0
volume of **FA 2** / cm^3	20.0	20.0	20.0	10.0
volume of water / cm^3	0.0	0.0	10.0	10.0
volume of **FA 3** / cm^3	4.0	4.0	4.0	4.0
time for colour to disappear / s				
'rate' of reaction				

Calculate each 'rate' and complete *Table 1.1*. [10]

As the total volume of liquid is the same in each experiment, the volume of any reagent can be used as a measure of its concentration.

For Examiner's Use

(b) Compare experiments 2 and 3.

(i) Which reagents have the same concentration in both experiments?

[1]

(ii) Which reagent has a different concentration?

[1]

(iii) How is the rate of reaction affected by the change of concentration of the reagent named in **(ii)**?

[3]

(c) Compare experiments 2 and 4.

(i) Which reagents have the same concentration in both experiments?

[1]

(ii) Which reagent has a different concentration?

[1]

(iii) How is the rate of reaction affected by the change of concentration of the reagent named in **(ii)**?

[3]

(d) A text-book states that the reaction is zero order with respect to iodine. What volumes of reagents, compared with experiment 2, would you mix to investigate this statement?

FA 1 ..... cm^3 **FA 2** ..... cm^3

water ..... cm^3 **FA 3** ..... cm^3

[1]

[Total : 21]

[Turn over

For Examiner's Use

2 ASSESSMENT OF PLANNING SKILLS

DO NOT CARRY OUT YOUR PLAN

A solid known as 'washing soda' consists of crystals of sodium carbonate-10-water, $Na_2CO_3.10H_2O$.

On exposure to air, the crystals slowly lose their water of crystallisation to become $Na_2CO_3.xH_2O$.

You are provided with a sample of 'washing soda' that has lost some of its water of crystallisation.

You are to devise a method involving weighing and heating of the sample that will enable you to find the percentage of water that has been lost from the crystals on exposure to air.

You may assume that anhydrous sodium carbonate is not decomposed by heat.

The normal apparatus to be found in a school Chemistry laboratory is available.

Outline, by a series of numbered steps, the apparatus to be used and the experimental work you would carry out, including the measurements to be taken, to find the mass of water remaining in the crystals.

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For Examiner's Use

Draw the table of results you would prepare to record the results of your experiment.

(a)	
(b)	
(c)	
(d)	
(e)	

[5]

Show how you would use the results of your experiment to find the percentage of water that has been lost by the crystals on standing in air.
Make use of the relative atomic masses in this section.
[A_r; Na, 23.0; C, 12.0; O, 16.0; H, 1.]

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.....[4]

(f)	
(g)	
(h)	
(i)	

[Total : 9]

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