Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CHEMISTRY **9701/05**

Paper 5 Practical Test

May/June 2003

1 hour 30 minutes

Candidates answer on the Question Paper.
Additional materials: As listed in the Instructions to Supervisors.

READ THESE INSTRUCTIONS FIRST

Write your details, including practical session and laboratory where appropriate, in the boxes provided.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams, graphs, or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
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.
You are advised to show all working in calculations.
Use of a Data Booklet is unnecessary.

SESSION
LABORATORY

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

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1	
2	
TOTAL	

This document consists of **5** printed pages and **3** blank pages.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate
[Turn over

1 **FB 1** is an aqueous solution containing 100.00 g dm^{-3} of sodium thiosulphate, $Na_2S_2O_3.5H_2O$.
FB 2 is an aqueous solution containing 0.023 mol dm^{-3} of the chromate ion, CrO_4^{2-}.

Chromate ions, CrO_4^{2-}, oxidise iodide ions, I^-, in the presence of acid, H^+, and produce aqueous iodine, I_2 which can be titrated with sodium thiosulphate. You are to use this reaction to show that the CrO_4^{2-} ion is reduced to Cr^{3+} during this reaction.

(a) Use a burette to measure between 45.0 cm^3 and 45.5 cm^3 of **FB 1** into the 250 cm^3 volumetric (graduated) flask labelled **FB 3**.
Record your burette readings in Table 1.1.

Table 1.1 Dilution of FB 1

Final burette reading	/ cm^3	
Initial burette reading	/ cm^3	
Volume of **FB 1**	/ cm^3	

[2]

Fill the flask to the mark with distilled or deionised water and mix the contents thoroughly by shaking.
This solution is **FB 3. Fill the second burette with the solution FB 3 you have prepared.**

(b) Pipette 25.0 cm^3 of **FB 2** into a conical flask and add, from a measuring cylinder, 10 cm^3 of dilute sulphuric acid and 10 cm^3 of 5% aqueous potassium iodide, KI.
Titrate the contents of the conical flask with **FB 3** until the colour of the iodine solution has faded to a light orange/yellow colour. Add 1 cm^3 of starch indicator and continue the titration until the blue-black colour of the starch-iodine complex disappears leaving the transparent pale blue colour of Cr^{3+}. Record your burette readings in Table 1.2.

Repeat the titration as many times as you think necessary to obtain accurate results.
Make certain that the recorded results show the precision of your practical work.

Table 1.2 Titration of FB 2 with FB 3

Final burette reading / cm^3 Initial burette reading / cm^3				
Volume of **FB 3** used / cm^3				

[10]

Summary

25.0 cm^3 of **FB 2** reacted with ..... cm^3 of **FB 3**.

Show which results you used to obtain this volume of **FB 3** by placing a tick (✓) under the readings in Table 1.2.

(c) Calculate the concentration in mol dm^{-3} of sodium thiosulphate, $Na_2S_2O_3.5H_2O$, in **FB 1**. [Na, 23.0; S, 32.1; O, 16.0; H, 1.0.]

[1]

(d) Calculate the concentration in mol dm^{-3} of sodium thiosulphate in the diluted solution **FB 3**.

[1]

(e) Calculate the number of moles of sodium thiosulphate run into the flask during the titration and use this figure and the equations below to calculate the moles of iodine, I_2, present in the titration flask.

$$2S_2O_3^{2-}(aq) \rightarrow S_4O_6^{2-}(aq) + 2e^-$$

$$I_2(aq) + 2e^- \rightarrow 2I^-(aq)$$

[2]

(f) Calculate the number of moles of CrO_4^{2-} ion pipetted into the titration flask.

[1]

(g) Calculate the number of moles of iodine, I_2, produced by 1 mole of CrO_4^{2-}.

[1]

(h) Use your answer to **(g)** and oxidation numbers to show that CrO_4^{2-} has been reduced to Cr^{3+}.

[2]

[Total 20]

For Examiner's Use

2 ASSESSMENT OF PLANNING SKILLS

Copper carbonate

decomposes on strong heating,

$$CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$$

reacts with hydrochloric acid.

$$CuCO_3(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + CO_2(g) + H_2O(l)$$

Carbon dioxide, CO_2, is an acidic oxide.
Copper oxide, CuO, is a basic oxide.

Malachite is a rock containing a high percentage of copper carbonate.
You are to plan an experiment to determine the % of copper carbonate in a specimen of malachite.
In your plan you may use any equipment normally found in a school laboratory.

You may assume that any other material present in the malachite is unaffected by heating and is neither acidic or basic.

In your plan you must include masses, volumes, concentrations of materials used as appropriate.

You will need to use some or all of the following information.
[Cu, 63.5; C, 12.0; O, 16.0.]
1 mole of any gas occupies a volume of approximately 24.0 dm^3 at room temperature and pressure.

DO NOT CARRY OUT YOUR PLAN

Plan

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[4]

a	
b	
c	
d	

Show how you would tabulate your results. All necessary measurements should be shown in the table(s).

[3]

Outline how you would process your results to find the % of copper carbonate in the sample of malachite.

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[3]

[Total 10]

e	
f	
g	

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