UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level and GCE Advanced Subsidiary Level

MARK SCHEME for the May/June 2006 question paper

9701 CHEMISTRY

9701/03 Paper 3

Maximum raw mark 25

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

The minimum marks in these components needed for various grades were previously published with these mark schemes, but are now instead included in the Report on the Examination for this session.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the May/June 2006 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

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Question 1

Supervisor's results

Check all subtractions in the titration table 1.1.
Select the titre average.
Record this value on the front of the Supervisor's script and as a ringed value by the titration table 1.1 on each candidate script.

(b) Candidate's results

Check all subtractions in the titration table 1.1. The subtraction of titration results labelled as rough need not be checked unless the candidate has included it in the volume used to calculate the average.

Tick (if accepting the candidate's value) or correct this value, recording it by titration table 1.1 on the script. Calculate the difference to the Supervisor's ratio.
Award **accuracy marks** for differences as follows:

Accuracy mark	
Mark	Difference to Supervisor / cm^3
7	Up to 0.20
6	0.20+ to 0.25
5	0.25+ to 0.30
4	0.30+ to 0.40
3	0.40+ to 0.50
2	0.50+ to 0.70
1	0.70+ to 1.00
0	Greater than 1.00

Spread Penalty	
Range used / cm^3	Deduction
0.20+ to 0.25	1
0.25 to 0.30	2
0.30+ to 0.35	3
0.35+ to 0.40	4
0.40+ to 0.60	5
0.60+ to 0.80	6
Greater than 0.80	7

[7]

Deduct from the accuracy mark **one mark** for **each** of the following errors:
(i) Final burette readings in Table 1.1 (except for any titration recorded as Rough) not recorded to 2 decimal places
or "impossible" burette readings (e.g. 23.47 cm^3) recorded at any point in the tables.
(ii) No two recorded (uncorrected) titres within 0.1 cm^3.
(iii) An incorrect average calculated **or** no selection of at least two titres for the calculation of the average.
Selected titres may be ticked or used in a calculation of the average.

THERE IS A MAXIMUM DEDUCTION OF TWO MARKS FROM THE ACCURACY MARKS.

In all calculations, ignore evaluation errors if working is shown.
Where an answer is given with no working the Examiner is to check the appropriate working and the answer must be correct for this working for marks to be awarded.

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(c) Give **one mark** for correctly calculating the concentration of $Na_2S_2O_3$

$$\frac{19.78}{158.2} \quad \textbf{or} \quad 0.125$$

Do **not** give this mark if an A_r of S = 32.0 has been seen to be used instead of 32.1 when calculating M_r of $Na_2S_2O_3$. (e.g. 158.0 given as M_r instead of 158.2).

Give **one** mark for $\frac{\textbf{Titre}}{1000}$ **x candidate's concentration of $Na_2S_2O_3$** **[2]**

(d) Give **one mark** for **answer to (c)** **x** $\frac{1}{2}$ **[1]**

(e) Give **two marks** for **answer to (c) or (d)** **x** $\frac{250}{25}$ **x** $\frac{1000}{25}$

one mark **one mark**

To gain either mark the answer to **(c)** or **(d)** must be used.
The second mark is independent of the first but must be clearly attributed to dilution of **FA 1** to **FA 3**.
Give **one mark** for a **fully correct answer** evaluated to within 1% of the concentration calculated by the Examiner from the candidate's results.
A candidate who used answer to (c) in this expression is not eligible for the evaluation mark
This mark may be given if 32.0 has been used in place of 32.1 for A_r of S in **(c)**.

The correct answer is given by **Candidate's titre x 0.02501** **[3]**

(f) Give **one mark** for **0.082** **x** $\frac{250}{50}$ **or** **0.41** **[1]**

(g) Give **one mark** for an answer that uses the concentrations calculated in **(e)** and **(f)** and calculates the cost of equal moles of each bleach to show the better buy from the candidates results.
(The expected concentration of **Superclean** is around 0.60 mol dm^{-3})
An appropriate calculation would be:
$\frac{0.60}{0.41}$ **x 1.80 = 2.63$** (**Germfree** is therefore the better buy) **[1]**

[Total for Question 1 = 15]

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Question 2 **FA 4** is propanone (acetone)
FA 5 is ethanoic acid (acetic acid)
FA 6 is ethanal (acetaldehyde)
FA 7 is ethanol (ethyl alcohol)

Tests
(a) magnesium powder (turnings)
(b) powdered sodium carbonate
(c) 2,4-dinitrophenylhydrazine
(d) Tollens reagent
(e) acidified potassium dichromate(VI)

Give **one mark** for observation of or reference to **gas evolved with FA 5 in tests (a) and (b)**.
Ignore any reference to gas evolved with **FA 6** as some ethanal may have been oxidised to ethanoic acid.
Withhold this mark if any gas is reported in tests (a) or (b) with FA 4 and FA7. **[1]**

Test	FA 4 (propanone)	FA 5 (ethanoic acid)	FA 6 (ethanal)	FA 7 (ethanol)
(a)		(gas evolved) Give **one mark** for gas identified as hydrogen by a suitable test.		
(b)		(gas evolved) Give **one mark** for gas identified as carbon dioxide by a suitable test.		
(c)	Give **one mark** for a yellow or orange precipitate		Give **one mark** for a yellow or orange precipitate	
(d)			Give **one mark** for a grey, brown or black colouration in the solution or for precipitate (or formation of a silver mirror)	
(e)			Give **one mark** for the solution turning green. (Allow a "brown" colour)	Give **one mark** for the solution turning green. (Allow a "brown" colour)

[7]

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IDENTIFICATION

Give **one mark** for **FA 5** is a (carboxylic) acid because of tests **(a)** and **(b)**
Allow identification (i) if mark awarded in **(a) and (b)**, (ii) both tests for gases were given or (iii) effervescence / fizzing / bubbles / rapid evolution of gas was recorded for each but **do not give mark** from gas given off.

Give **one mark** for **FA 7** is an alcohol because of test **(e)** or by **elimination** (if no $Cr_2O_7^{2-}$ available or there are no reactions in tests).
Allow tertiary alcohol if there is no change with $Cr_2O_7^{2-}$ and other identities are correct.

[2]

[Total for Question 2 = 10]

[Total for Paper = 25]

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