UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level and GCE Advanced Subsidiary Level

MARK SCHEME for the May/June 2006 question paper

9701 CHEMISTRY

9701/05 Paper 5

Maximum raw mark 30

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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1 (a) Give **one mark** if all times in Table 1.1 are recorded to the nearest second (no decimal places shown) **[1]**

Give **one mark** for recording $\mathbf{lg}\left(\frac{\mathbf{1000}}{\mathbf{time}}\right)$ to 2 decimal places. **[1]**

Convert to seconds any time which is clearly in "stop-clock" format e.g. 1.06 or 1.06.33

Calculate (volume of FB 1 x candidate's recorded time) for *Experiments 1*, *2* and *3*. *Record the Vt for each experiment to the left of Table 1.1 against the appropriate experiment.*

Calculate: $\frac{\mathbf{(Largest\ Vt\ value\ -\ Smallest\ Vt\ value)}}{\mathbf{Largest\ Vt\ value}}\ \mathbf{x\ 100}$

If this value is ≤ 5% award the maximum of 6 accuracy marks.

If this value is greater than 5%, select the closer pair and calculate the % in a similar way:

$\frac{\mathbf{(Larger\ Vt\ value\ -\ Smaller\ Vt\ value)}}{\mathbf{Larger\ Vt\ value}}\ \mathbf{x\ 100\ then}$

Calculate the difference between the remaining Vt value and the value used in the expression above which is further from it (i.e. the larger of the two possible differences).

Use this difference to calculate: $\frac{\mathbf{Difference\ between\ 3rd\ value\ and\ further\ of\ pair}}{\mathbf{Further\ of\ pair}}\ \mathbf{x\ 100}$

e.g. **1800**] **Closest pair - 2 within 5%**
1760]
1590

Take the difference between 1590 and 1800, the **further** of the 5% pair.

The difference (210) is calculated as a % of 1800, the **further** of the 5% pair.

$\frac{\mathbf{210}}{\mathbf{1800}}\ \mathbf{x\ 100\ = 11.7\%}$ **1 within 20%**

e.g. **1400**
1290] **Closest pair - 2 within 5%**
1250]

Take the difference between 1400 and 1250, the further of the 5% pair.

The difference (150) is calculated as a % of 1290, the **larger** of the 5% pair.

$\frac{\mathbf{150}}{\mathbf{1250}}\ \mathbf{x\ 100\ = 12.0\ \%}$ **1 within 20%**

Award accuracy marks as shown on the following page:

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Award accuracy marks as follows:

6 Marks	5 Marks	4 Marks	3 Marks	2 Marks	1 Mark
All 3 Vt values within 5% of largest	2 Vt values within 5% of the larger of the closer pair Spread of all 3 values is ≤ 10% of the larger of the 5% pair	2 Vt values within 5% of the larger of the closer pair Spread of all 3 values is ≤ 20% of the larger of the 5% pair	2 Vt values within 5% of the larger of the closer pair Spread of all 3 values is ≤ 25% of the larger of the 5% pair	2 Vt values within 5% of the larger of the closer pair Spread of all 3 values is ≤ 40% of the larger of the 5% pair	
	All 3 Vt values within 7.5% of largest	2 Vt values within 7.5% of the larger of the closer pair Spread of all 3 values is ≤ 12.5% of the larger of the 5% pair	2 Vt values within 7.5% of the larger of the closer pair Spread of all 3 values is ≤ 20% of the larger of the 5% pair	2 Vt values within 7.5% of the larger of the closer pair Spread of all 3 values is ≤ 30% of the larger of the 5% pair	Any 2 Vt values within 7.5% of the larger of the closer pair
		All 3 Vt values within 10% of largest	2 Vt values within 10% of the larger of the closer pair Spread of all 3 values is ≤ 15% of the larger of the 5% pair	2 Vt values within 10% of the larger of the closer pair Spread of all 3 values is ≤ 20% of the larger of the 5% pair	2 Vt values within 10% of the larger of the closer pair Spread of all 3 values is ≤ 35% of the larger of the 5% pair
			All 3 Vt values within 12.5% of largest	2 Vt values within 12.5% of the larger of the closer pair Spread of all 3 values is ≤ 17.5% of the larger of the 5% pair	2 Vt values within 12.5% of the larger of the closer pair Spread of all 3 values is ≤ 30% of the larger of the 5% pair
				All 3 Vt values within 15% of largest	2 Vt values within 15% of the larger of the closer pair Spread of all 3 values is ≤ 25% of the larger of the 5% pair
					All 3 Vt values within 17.5% of largest

[6]

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Graph

Give **one mark** if $\mathbf{lg}\left(\frac{\mathbf{1000}}{\mathbf{time}}\right)$ is plotted on the y axis and **lg(volume of FB 1)** on the x axis, both axes have been labelled (ignore units) **and** easily used linear scales with points plotted over 50% of each axis have been used. **[1]**

The Examiner is to check the plotting of the five points.

Give **two marks** if all five points (candidate's values) are plotted within ½ small square (and in the correct small square), in either direction, of the point selected by the Examiner.

Deduct one mark for each point incorrectly plotted (no negative marks). **[2]**

Give **one mark** for a best-fit straight line.

If points are not in line or very close to being in line, the line of best fit must be drawn so as to 'cancel out' any discrepancies. The total distance (perpendicular to the drawn line) to the left should equal (as far as possible) the total distance to the right. If the candidate makes it clear that a point is being ignored this mark can be given for a line drawn through 4 points alone.

This mark is unlikely to be awarded where points are incorrectly plotted (or there has been error in calculation in Table 1.1). **If all the points are within a 4 adjacent squares, do not give this mark**. **[1]**

(c) Give **one mark** for stating that there is a constant (total) volume in each experiment. **[1]**

(d) Give **one mark** for stating that the volume of **FB 1** is proportional to its concentration (or equivalent statement).
Providing that a mark has been given in (c) or the candidate states in (d) that the total volume is kept constant -
Give **one mark** for $[Na_2S_2O_3]$ is directly proportional to. volume of **FB 1** or equivalent mathematical expression
There is no retrospective mark in **(c)** *for a candidate who refers to constant (total) volume in* **(d)**

[2]

(e) Give **one mark** for construction lines on the graph or graph extended to axes

Give **one mark** for numerical values (from the construction) used in a calculation

Give **one mark** for a suggested order that fits the experimental value. Do **not** give if calculation inverted. **[3]**

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(f) Give **one mark** if the total volume of solution is 55 cm^3 in each experiment
Give **one mark** if the volume of **FB 1** is 40 cm^3 in each experiment
Penalise 1 mark if the volumes are exactly the same as in expt. 2.

Penalise 1 mark if volume of FB2 is same in two or more experiments.

Give **one mark** for correctly calculating $\left(\frac{\mathbf{1000}}{\mathbf{time}}\right)$ for both experiments 6 and 7.

Each a*nswer must be correctly rounded to the significant figure shown (minimum is 2 s.f.)* **[3]**

(g) Give **one mark** for a comment on rate (or time)/concentration of HC*l* that fits the experimental results.

[1]

[Total: 22]

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ASSESSMENT OF PLANNING SKILLS.

(a) Give **one mark** if the apparatus is suitable for: heating and reducing the copper oxide in a stream of hydrogen gas.

Give **one mark** for "real apparatus" that:
is capable of being disconnected to weigh oxide/copper and water *(Ignore any chemical included to absorb condensate)*;
shows how the steam is condensed to water.

Give **one mark** for a suitable means of burning excess hydrogen at the end of the apparatus. **[3]**

(b) Give **one mark** for any of the following:

(i) flushing the apparatus with an inert gas,

(ii) passing hydrogen through the apparatus to flush out air,

(iii) testing small portions of mixture (e.g. in a test-tube) before igniting excess.

(iv) remove air from the apparatus – **by some practical method, e.g. evacuation** **[1]**

(c) Give **one mark** for preventing copper from re-oxidising / keeping air away from the hot copper or equivalent. **[1]**

(d) Give **one mark** for reference to reheating/reweighing or heating to constant mass. **[1]**

(e) Give **one mark** for a calculation to obtain appropriate moles of CuO and Cu_2O, water, copper.

Give **one mark** for relating the calculated moles to quantities in the equation. **[2]**

[Total: 8]

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