CAMBRIDGE
INTERNATIONAL EXAMINATIONS

JUNE 2003

GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 25

SYLLABUS/COMPONENT: 9701/03

CHEMISTRY
Practical 1

1 (a) Table 1.1

Do not penalise times that have been recorded to 1 or 2 decimal places.

The Examiner is to inspect the candidate's calculation of $\frac{1000}{time}$.

If the candidate has recorded the ratio to more (or less) than 1 decimal place there is no need to check the calculation for **experiments 1, 3 and 5** unless $\frac{1000}{time}$ is an integer.

If all 6 calculations are recorded to 1 decimal place **the Examiner** is to check the calculation for **experiments 1, 3 and 5**. (**X.X5** may be rounded up or down.)

Give **one** mark if all three are correctly calculated. **1**

The Examiner is to calculate **volume of FA 1 x Time <u>to the nearest second</u> for experiments 1, 3 and 5.**

If the candidate fails to complete experiments 1, 3 and 5 or states that a value is inaccurate/unreliable; work with the closest available value.

Award accuracy marks as follows:

List the three **Vt** values in decreasing numerical order.
The % difference will always be assessed on the top or middle value.
Where all three values are not within 10% of the largest value, identify the closest pair,

e.g. **1800** } **Closest pair - 2 within 10%**
1760 }
1590

Take the difference between 1590 and 1800, the **further** of the 10% pair.
The difference (210) is calculated as a % of 1800, the **greater** of the 10% pair.

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

e.g. 2 **1400**
1290 } **Closest pair - 2 within 10%**
1250 }

Take the difference between 1400 and 1250, the **further** of the 10% pair.
The difference (150) is calculated as a % of 1290, the **greater** of the 10% pair.

$$\frac{150}{1290} \times 100 = 11.6\%$$ **1 within 20%**

Award marks:

Mark	volume of FA 1 x Time
6	If all three values are within 10% of the largest
5	If all three values are within 15% of the largest or Two values are within 10% of the larger of the closest pair and the spread of all three values is ≤ 20% of the larger of the closest pair
4	If all three values are within 20% of the largest or Two values are within 15% of the larger of the closest pair and the spread of all three values is ≤ 25% of the larger of the closest pair or Two values are within 10% of the larger of the closest pair and the spread of all three values is ≤ 40% of the larger of the closest pair
3	If all three values are within 25% of the largest or Two values are within 20% of the larger of the closest pair and the spread of all three values is ≤ 30% of the larger of the closest pair or Two values are within 15% of the larger of the closest pair and the spread of all three values is ≤ 40% of the larger of the closest pair or Two values are within 10% of the larger of the closest pair and the spread of all three values is ≤ 50% of the larger of the closest pair
2	If all three values are within 30% of the largest or Two values are within 25% of the larger of the closest pair and the spread of all three values is ≤ 35% of the larger of the closest pair or Two values are within 20% of the larger of the closest pair and the spread of all three values is ≤ 40% of the larger of the closest pair or Two values are within 15% of the larger of the closest pair and the spread of all three values is ≤ 60% of the larger of the closest pair or Two values are within 10% of the larger of the closest pair and the spread of all three values is ≤ 80% of the larger of the closest pair

1	If all three values are within 35% of the largest or Two values are within 30% of the larger of the closest pair and the spread of all three values is ≤ 50% of the larger of the closest pair or Two values are within 25% of the larger of the closest pair and the spread of all three values is ≤ 60% of the larger of the closest pair or Two values are within 20% of the larger of the closest pair and the spread of all three values is ≤ 70% of the larger of the closest pair or Two values are within15% of the larger of the closest pair and the spread of all three values is ≤ 80% of the larger of the closest pair or Any two values are within 10% of the larger
0	Outside the above ranges

6

(b) Give **one mark** for any answer that explains that: **Take care not to miss this mark**

the unit of rate is **"per second" or** short time = fast rate, long time = slow rate

or **Rate** $\propto \frac{1}{time}$

In less clear answers - reward the idea of 'division by time'.

1

(c) **Graph**

Give **one mark** for plotting with a suitable scale on the *y* axis.
Points must be plotted over more than ½ of the *y* axis.
(Place a tick or cross at the top of the y axis and mark in the margin)

Give **two marks** if the points for **experiment 1, experiment 3 and experiment 5** are plotted correctly.
Points must be **precisely** placed on the appropriate vertical line and be in the correct square and within ½ a square of the Examiner plotted point.
If the candidate has not carried out the experiment or not plotted the point, check an adjacent point. (Two points correctly plotted earns one mark)
(Indicate correct plotting with a small tick or cross below each appropriate volume on the y axis and mark in the margin)

Give **one mark** for any straight line, drawn with a ruler, which relates to the results.
Give **one mark** for a smooth curve or straight line passing **precisely** through the origin.
(Place ticks or crosses against the line and marks in the margin)

5

(d) **If a straight line has been drawn** (that has reasonable correlation to the points plotted but does not have to go through the origin) **or**
(There is a statement - that fits the evidence - about what graph should have been drawn)

Give **one mark** for

rate of reaction is directly proportional to concentration of (sodium thiosulphate)
or
explanation such as doubling concentration, doubles rate
or
1st order (wrt sodium thiosulphate)

If a smooth curve has been drawn (that has reasonable correlation to the points plotted but does not have to go through the origin)

Give **one mark** for

concentration (of sodium thiosulphate) is related in some way to **but** is not directly proportional. If the candidate states that there is some proportional relationship they must also say it is not **directly proportional** to get this mark.

Do NOT give this mark if the line drawn is not justified by the results of the experiments. If NO LINE has been drawn and there is a scatter of points on the graph.

Give **one mark** for

there is no correlation or no proportionality
or
is not 1^{St} order (wrt sodium thiosulphate)

1

(e) Give **one mark** for

Volume (of **FA 1**) becomes a measure of concentration
or To keep the depth of solution constant **or** Same amount of sulphur produced
or Constant opacity **or** $Na_2S_Z0_3$ only variable

1

Total for Question 1 **15**

2 **FA 3** is a mixture of two solids, **FA 4** which is soluble in water contains NH_4^+ and I^-, **FA 5** which is insoluble in water contains Mg^{2+} and $C0_3^{2-}$.

Tip the solid **FA 3** into a boiling tube, add distilled water until the tube is half full, stopper and shake for about 30 seconds. Filter the mixture and retain both the filtrate and the residue in the filter paper.

Tests on the Filtrate (FA 4)

(a) To 2 cm depth of the filtrate in a boiling-tube, add 2 cm depth of aqueous sodium hydroxide then carefully warm the solution.	No reaction, no change, stays colourless or no precipitate **one mark** Ammonia or gas turning (red) litmus blue etc. **one mark** **2**
(b) To 1 cm depth of the filtrate in a test-tube, add 1 cm depth of aqueous lead nitrate.	Yellow precipitate **one mark** *(Ignore solubility of ppt or subsequent change in colour)* **1**
(c) To 2 cm depth of the filtrate in a test-tube, add 2 cm depth of aqueous hydrogen peroxide followed by 1 cm depth of dilute sulphuric acid.	Yellow-brown, orange-brown, red-brown, brown solution **or** Grey or black ppt or Iodine (formed/liberated) **one mark** **1**

Tests on the Residue (FA 5)

(d) Transfer the solid residue from the filter paper to a boiling-tube and add a minimum quantity of dilute hydrochloric acid to dissolve the solid. Divide the solution into two parts and use one part for each of the following tests.	Effervescence, fizzing, carbon dioxide or gas turning lime water milky **one mark** **1**
To one part add aqueous sodium hydroxide.	White precipitate, insoluble in excess **one mark** **1**
To the other part add dilute aqueous ammonia.	White precipitate, insoluble in excess **one mark** **1**

Give **one mark** for correctly identifying the ions in **FA 4** as **NH_4^+ and I^-**.
(Do not give this mark if additional ions are included)

Give **one mark** for a deduction about one of the ions stated to be present providing the deduction fits the recorded observation (**Incorrect ions may gain marks here - ecf**)

If there is a string of ions, including NH_4^+ and I^-, the deduction must be for NH_4^+ or I^-.

Give **one mark** for correctly identifying the ions in **FA 5** as **Mg^{2+} and CO_3^{2-}**.

Give **one mark** for a correct deduction to support the identification of one of the ions stated to be present (**ecf**)

[**Where the Identity of ions in FA 4 have clearly been recorded as FA 5 or vice versa** the deduction mark may be awarded but not the mark for the identity of the ions]

Cancel any mark in excess of 10.

Total for Question 2 is 10 and for the Paper 25