UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary and Advanced Level

MARK SCHEME for the June 2005 question paper

9701 CHEMISTRY

9701/03 **Paper 3 (Practical Test), 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*.

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

CIE is publishing the mark schemes for the June 2005 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

Grade thresholds for Syllabus 9701 (Chemistry) in the June 2005 examination.

	maximum mark available	minimum mark required for grade:		
		A	B	E
Component 3	25	17	15	8

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.

June 2005

GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 25

SYLLABUS/COMPONENT: 9701/03

CHEMISTRY
Paper 3 (Practical Test)

UNIVERSITY of CAMBRIDGE
International Examinations

Question 1

(a) Candidate's results

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

Calculate the difference to the Supervisor's titre.

Award **accuracy marks** for differences as follows:

Accuracy mark	
Mark	Difference to Supervisor
7	Up to 0.10
6	0.10+ to 0.15
5	0.15+ to 0.20
4	0.20+ to 0.30
3	0.30+ to 0.40
2	0.40+ to 0.60
1	0.60+ to 0.80
	Greater than 0.80

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)

The expected titre is about 26.45 cm^3

Deduct from the accuracy mark **one mark** for **each** of the following errors **(Max deduction of 2):**
Indicate near the titration table which penalty you are applying.

(i) Final burette readings in Table 1.1 not recorded to 2 decimal places **or** "Impossible" burette readings (e.g. 23.47 cm^3) recorded at any point in the table **or** Initial and Final burette readings transposed; 50 used as Initial burette reading **or** Final burette reading $>$ 50.0 cm^3.

(ii) No two recorded (uncorrected) titres within 0.1 cm^3.

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(iii) An incorrect average calculated **or** no selection of at least two titres for the calculation of the average
(Selected titres may be those ticked or shown in a calculation of the average)
or an error in subtraction in **any** accurate titration (or titre labelled rough if ticked and used in calculating the average).

Record below the titration table, (Raw accuracy mark – penalties – spread penalty). Record the "net" mark in the right hand column.

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 given correct for this working.

(b) Give **two marks** for $\frac{2.37}{158}$ **(or 0.015)** **(one)** **x** $\frac{\text{titre in cm}^3}{1000}$ **(one)** **or**

$\frac{2.37}{158}$ **(or 0.015)** **x** **titre in dm^3**

To score either mark, 2.37 must have been used in the calculation

Do not give the first mark if:

55 has been **included in an expression** as A_r of Mn rather than the stated value, 54.9
or
39 has been **included in an expression** as A_r of K rather than the stated value, 39.1. **(2)**

(c) Give **one mark** for **answer to (b) x** $\frac{5}{2}$ **(1)**

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(d) Give **two marks** for **answer to (c) x 90 x $\frac{1000}{25}$** **or**

(one) (one)

answer to (c) x 90 x 40

No marks are to be awarded if the answer to (c) has not been used unless the answer has been started again from first principles.

Apply a +/- approach if an additional term has been introduced into the calculation:

answer to (c) x 90 x $\frac{1000}{25}$ x [?]

(+1) (+1) (-1)

1 mark

answer to (c) x $\frac{1000}{25}$ x [?]

(+1) (-1)

0 marks

Give **one mark** if the answers to **(b)** and **(c)** are correct and the answer to **(d)** has been evaluated to within 1% of the value calculated by the Examiner from the candidate's results.
(The evaluation mark may be given where A_r 55/39 has been used for Mn/K in (b))

The expected answer is given by **Candidate's titre x 0.135** *(Ignore units)*

(3)

(e) Give **one mark** for **5.00 - answer to (d)** **(1)**

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(f) Give **one mark** for converting masses to moles and calculating

$$\frac{\textbf{moles of water}}{\textbf{moles of } H_2C_2O_4}$$

The mark is for the process, not for the answer given which may be left as a decimal or rounded to the nearest whole number.

The expected answer to **(f)** is given by $\mathbf{x} = \dfrac{\textbf{5 x answer to (c)}}{\textbf{answer to (d)}}$

Check all calculations carefully as there are many ways of determining the value of **x**.

Some examples are given below:

The most likely method is to calculate $\dfrac{\textbf{mass of water}}{\textbf{18}}$ and

$\dfrac{\textbf{mass of anhydrous acid}}{\textbf{90}}$ then compare the ratios to calculate **x**.

$\dfrac{\textbf{mass of anhydrous acid}}{\textbf{90}}$ may already have been calculated in **(d)**

Other possible calculations

$$\frac{\textbf{mass of anhydrous solid}}{\textbf{mass of crystals}} = \frac{\textbf{90}}{\textbf{(90 + 18x)}} \quad \textbf{or} \quad \frac{\textbf{mass of water}}{\textbf{mass of crystals}} = \frac{\textbf{18x}}{\textbf{(90 + 18x)}}$$

$$\textbf{M}_\textbf{r}\textbf{ of hydrated salt} = \frac{\left(\dfrac{\textbf{5}}{\textbf{40}}\right)}{\textbf{answer to (c)}}$$ Then subtract 90 and divide by 18.

$$\frac{\textbf{answer to (e)}}{\left(\textbf{answer to (c)} \times \dfrac{\textbf{1000}}{\textbf{25}} \times \textbf{18}\right)}$$

$$\frac{\left(\dfrac{\textbf{mass of } H_2O}{\textbf{mass of hydrated salt}} \times \textbf{90}\right)}{\textbf{18}}$$

(1)

(Total for Question 1 = 15)

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Question 2 **FA 3** contains barium nitrate and chromium(III) chloride.

	Test	*Observations [6]*	
(a)	To 3 cm depth of **FA 3** in a boiling-tube, add 2 cm depth of dilute sulphuric acid. Warm the mixture and leave to stand for several minutes. Continue with test **(b)**.	*Ignore initial grey-green of green precipitate* Give **one mark** for a white precipitate	**(1)**
	Use a teat pipette to transfer 1 cm depth of the solution into a test-tube and add an equal depth of distilled water. Add aqueous sodium hydroxide, drop by drop, until there is no further change.	Give **one mark** for a (grey/grey-green/green) precipitate soluble in excess to form a **dark green** solution Do **not** give this mark if the precipitate has any colour **other** than grey/grey-green/green.	**(1)**
(b)	To 1 cm depth of **FA 3** in a boiling-tube, add 2 cm depth of aqueous sodium hydroxide. Add a piece of aluminium foil and warm the tube. Care – solutions containing sodium hydroxide when heated can "bump" and eject the hot alkali from the tube.	Give **one mark** for a **chemical test** for ammonia gas Accept gas turning named indicator paper an appropriate colour **or** white smoke/fumes with <u>concentrated</u> hydrochloric acid *Do not give this mark for alkaline gas or ammonia named but not tested*	**(1)**
(c)	To 3 cm depth of **FA 3** in a boiling-tube, add an equal depth of aqueous ammonia. <u>Filter the solution.</u>	Give **one mark** for a grey or grey-green precipitate	**(1)**
	Add aqueous potassium chromate(VI) to the filtrate.	Give one mark for a (pale or bright) yellow precipitate	**(1)**
(d)	To 3 cm depth of FA 3 in a boiling-tube, add 1 cm depth of aqueous silver nitrate. Warm the mixture and carefully pour away the solution. Wash the precipitate that remains with distilled water and discard the water. Add aqueous ammonia to the washed precipitate.	Give **one mark** for a white precipitate **that is** …….. Soluble in aqueous ammonia (There must be a definite statement that the precipitate is soluble, dissolves or disappears) Both observations are needed for the mark *(Watch out for a white precipitate **forming** with aqueous ammonia)*	**(1)**

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Give **one mark** for correctly identifying a cation as barium/Ba^{2+} **or** Lead(II)/Pb^{2+}
and giving supporting evidence: Tests **(a)(i)** or **(c)(ii)**

Do **NOT** award marks for barium **AND** for lead on the same script.

Give **one mark** for correctly identifying a cation as chromium(III)/Cr^{3+}
and giving supporting evidence: Tests **(a)(ii) or (c)(i) NOT (b)**

The minimum evidence for chromium is:

A grey-green precipitate in **(c)(i)**,
A precipitate (green or grey-green or of unspecified colour) which is soluble in excess sodium hydroxide in **(a)(ii)**.
Do **not** give this mark for a precipitate of any other colour e.g. white precipitate.

Give **one mark** for correctly identifying an anion as: nitrate/NO_3^-
and giving supporting evidence: Test **(b)**

This deduction may be made from a non-scoring observation of ammonia or alkaline gas in **(b)**

Nitrite/NO_2^- is wrong as there is no NO/NO_2 evolved in test **(a)**

Give **one mark** for correctly identifying an anion as: chloride/Cl^-
and giving supporting evidence: Test **(d)**

The minimum evidence for chloride is:

A white precipitate with silver (nitrate),
A precipitate (white or of unspecified colour) that is soluble in aqueous ammonia in **(d)**

Do not award marks for the identity of the ions unless appropriate observations for those ions have been seen on the script.

Do not penalise cations recorded as anions or vice versa.
(Formulae of ions, if given, must be correct). **(4)**

Where an **incomplete observation is completed** in the supporting evidence the observation mark may be awarded retrospectively.

E.G. A white precipitate only in **(d)** does not score the observation, but the mark can be given if the supporting evidence refers to the precipitate in **(d)** dissolving in ammonia.

Be careful **not** to award any retrospective observation mark where the recorded observation is not partially correct and the evidence for the ion has been clearly copied from the Qualitative Analysis Notes.

(Total for Question 2 = 10)

(Total for Paper = 25)

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