UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2006 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 instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began.

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 grade thresholds for various grades are published in the report on the examination for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses.

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

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

UNIVERSITY of CAMBRIDGE
International Examinations

Question 1

(b) Candidate's results

Check (and correct if necessary) all subtractions in Tables 1.1 and 1.2. The subtraction of titration results labelled as rough need not be checked unless the candidate has included them in the volumes used to calculate the average.

Tick (if accepting the candidate's value) or correct this value, recording it by titration Table 1.2 on the script.

Calculate for each candidate:

$$\textbf{Candidate's Titre} \times \frac{\textbf{Candidate's volume of FA 1 diluted}}{\textbf{Supervisor's volume of FA 1 diluted}}.$$

Record this titre, **correct to two decimal places**, against Table 1.2 and calculate the difference between the calculated value and the Supervisor's titre.

Award accuracy marks on the difference as shown on the next page.

© UCLES 2006

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

Accuracy mark	
Mark	Difference to Supervisor / cm^3
8	Up to 0.20
7	0.20+ to 0.25
6	0.25+ to 0.30
5	0.30+ to 0.40
4	0.40+ to 0.60
3	0.60+ to 0.80
2	0.80+ to 1.00
1	1.00+ to 1.50
0	Greater than 1.50

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 0.50	5
0.50+ to 0.60	6
0.60+ to 0.80	7
Greater than 0.80	8

[8]

Deduct from the accuracy mark **one mark** for **each** of the following errors:

(i) Volume diluted, as recorded by the candidate in the final line of Table 1.1 is outside of the range 34.00 cm^3 to 35.00 cm^3.

Ignore any subtraction error that would take the volume out of range

(ii) Any Initial and Final Burette reading transposed or 50 used as initial burette reading in either table **or**

Final burette readings in either table (except for any titration recorded as Rough) not recorded to 2 decimal places, **or**

"impossible" burette readings (e.g. 23.47 cm^3) recorded <u>at any point</u> in either of the tables.

All <u>final</u> burette readings = 50 cm^3.

(When assessing titration volumes to use you will need to consider this case carefully. Is there a general inversion of initial and final burette readings with 50 used instead of 0 or is this a genuine claim that all titres finished on 50 cm^3. The volume run out will be the best evidence to use)

(iii) No two recorded (uncorrected) titres within 0.1 cm^3 in Table 1.2.

(iv) An incorrect average calculated **or**

No selection of at least two titres for the calculation of the average shown (selected titres may be ticked or used in a calculation of the average.) **or**

Error in subtraction in any accurate titre (any rough titre if included in selection of titres to calculate the average) or error in subtraction in Table 1.1

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

© UCLES 2006

*If 34.5 cm^3 of **FA 1** are diluted, the expected titre is around 25 cm^3.*
Evaluations for these values are given, in boxes, as a guide to expected values

(c) Give **one mark** for calculating the correct concentration in mol dm^{-3} $\frac{4.93}{214.1}$ **or** **0.023(0)**

Do not give this mark if K = 39.0 has been used.

Give **one mark** for $\frac{25}{1000}$ **x concentration in mol dm^{-3} calculated by candidate**

or

Give **one mark** for $\frac{4.93}{1000}$ **x 25** and **one mark** for this expression **x** $\frac{1}{214.1}$

(one) **(one)**

The answer **5.75(7) x 10^{-4}** with no working gains both marks

5.75(7) x 10^{-4}

[2]

(d) Give **one mark** for **ans (c) x 6** **or** **3.45(4) x 10^{-3}**

3.45(4) x 10^{-3}

[1]

(e) Give **one mark** for **ans (d) x** $\frac{1000}{\text{Candidate's Titre}}$

0.138

[1]

(f) Give **two marks** for **ans (e) x** $\frac{250}{\text{Candidate's volume of FA 1 diluted}}$ **x 36.5**

one **one**

Give **one** of these two marks for any answer where only **(e) x 36.5** is seen.

1.001

36.54

and

Give **one mark** for a fully correct answer within 1% of the value calculated by the examiner.
Do not give this mark if there are 'chemical' errors in **(c)** to **(f)** even if these errors are self-cancelling.
The mark may be given if 214 rather than 214.1 has been used for M_r of KIO_3, providing the final answer is within 1% of the examiner calculated value

The correct answer is: $\frac{31517.69}{\text{Candidate's Titre X Candidate's volume of FA 1 diluted}}$

[3]

[Total for Qn 1 15]

© UCLES 2006

2 **FA 6** is a mixture of soluble **FA 7** (ammonium chloride) and insoluble **FA 8** (manganese(II) carbonate)

Some centres were unable to obtain manganese(II) carbonate and have been instructed to use magnesium zinc or copper carbonate. Magnesium carbonate was the recommended choice.

RETROSPECTIVE OBSERVATION MARKS MAY BE EARNED FROM THE CONCLUSIONS WHERE INCOMPLETE INFORMATION RECORDED, IN THE OBSERVATION BOX, AGAINST THE TEST IS COMPLETED.

DO NOT GIVE RETROSPECTIVE MARKS FOR CONTRARY INFORMATION

Tests on the Filtrate FA 7

Test	*Observations*	
(b) To 1 cm depth of the filtrate from (a) in a boiling-tube, add 2 cm depth of aqueous sodium hydroxide.	Give **one mark** for No ppt. / colourless solution / no reaction *(allow slightly brown – as $MnCO_3$ might not be fresh)* ***No yellow or orange colours***	**1**
Gently warm the solution. *Take care as a solution containing sodium hydroxide may 'bump' on heating and eject hot corrosive sodium hydroxide.*	Give **one mark** for **Gas** evolved – **turns** red litmus blue (or other appropriate **test** for ammonia **gas**) *Ignore any precipitate in this section*	**1**
(c) To 1 cm depth of the filtrate from **(a)** in a test-tube, add 1 cm depth of aqueous lead nitrate, then	Give **one mark** for White precipitate **which is**	
heat the mixture to boiling point, then	soluble/partially soluble in hot water	**1**
cool the tube by standing in a beaker of cold water	Give **one mark** if the (white) <u>precipitate reforms</u> or **crystals** form	**1**
(d) To 1 cm depth of the filtrate from **(a)** in a test-tube, add 1 cm depth of aqueous silver nitrate.	Give **one mark** for White precipitate ……..	
Then add 5 cm depth of dilute aqueous ammonia.	Soluble in aqueous ammonia	**1**

TO GAIN ANY DEDUCTION MARK THERE MUST BE REFERENCE TO THE REAGENTS. REFERENCE TO THE TEST ALONE IS SUFFICIENT PROVIDING THE OBSERVATION MARK HAS BEEN GIVEN FOR THAT TEST.

Give **one mark** if the cation in **FA 7** is identified as NH_4^+ or ammonium **<u>and</u>**

there is reference to ammonia evolved / alkaline gas / gas turning red litmus blue (on heating with sodium hydroxide.) **There must be a clear or unambiguous link to test (b) part (ii).** **[1]**

Give **one mark** if the anion is identified as Cl^- **<u>and</u>**

There is reference to white precipitate with Pb^{2+} **or** white ppt, soluble in ammonia with Ag^+. **[1]**

© UCLES 2006

Tests on the residue FA 8

	Test	*Observations [3]*	
(e)	Transfer the residue to a boiling-tube and add 4 cm depth of dilute hydrochloric acid. Retain the solution for tests **(f)** and **(g)**.	Give **one mark** for Gas evolved turns lime-water milky / cloudy / chalky or gives a white ppt with $Ca(OH)_2$ Details of the test may be given in the conclusion	**1**
(f)	To 1 cm depth of the solution from **(e)** in a test-tube add, a little at a time, 5 cm depth of aqueous sodium hydroxide.	Give **one mark** for Off-white / buff / pale-brown ppt. Insoluble in excess (NaOH) [For Mg^{2+} - white ppt insol in excess For Zn^{2+} - white ppt sol in excess For Cu^{2+} - blue ppt insol in excess]	**1**
(g)	To 1 cm depth of the solution from **(e)** in a test-tube add, a little at a time, 5 cm depth of dilute aqueous ammonia.	Give **one mark** for Off-white / buff / pale-brown ppt. Insoluble in excess ($NH_3(aq)$) [For Mg^{2+} - white ppt insol in excess For Zn^{2+} - white ppt sol in excess For Cu^{2+} - <u>pale</u> blue ppt sol in excess **or** blue ppt sol in excess to form a deep blue soln]	**1**

Give **one mark** if the cation in **FA 8** is identified as Mn^{2+} or manganese(II) [Mg^{2+}, Zn^{2+}, Cu^{2+}] **<u>and</u>**

There is reference to the colour of the precipitate and insolubility of precipitate in excess of sodium hydroxide and aqueous ammonia **<u>or</u>**

reference to an **off-white precipitate** in each test. **[1]**

Allow deductions of other cations, given from incorrect observations, providing all observations – including the solubility of any precipitate in excess NaOH and ammonia for the ion given.

e.g. deduction of Fe^{3+} from brown or red-brown precipitate, insoluble in excess aqueous NaOH and ammonia.

Give **one mark** if the anion is identified as CO_3^{2-} or carbonate **<u>and</u>**

there is reference to effervescence with hydrochloric acid **or** **[1]**

carbon dioxide is named (without a confirmatory test) as the gas given off **<u>and</u>** effervescence is an observation in **(e)** **or**

there is reference back to a positive test for carbon dioxide in **(e)**.

There are 12 scoring points. If a candidate scores in excess of 10 points record the raw score, crossed through and replaced by 10 max.

[Total for Qn 2 10]

[Total for Paper 25]

© UCLES 2006