Cambridge International AS & A Level

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CHEMISTRY **9701/33**

Paper 3 Advanced Practical Skills 1 **October/November 2017**

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, 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, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2017 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

Question	Answer	Marks
1(a)	**I** The following data is shown • two burette readings for the rough titration • titre for rough titration • initial **and** final burette readings for **two** (or more) accurate titrations *(i.e. 2 × 2 "box")*	**1**
	II Appropriate headings and units for accurate titration. **and** volume **FA 1** added recorded for each accurate titre. *Headings should match readings.* • initial / start **and** (burette) reading / volume (*allow vol but not V*) • final / end **and** (burette) reading / volume • titre **or** volume / **FA 1 and** used/added *(but not "difference" or "total" or "change")* unit: / cm^3 **or** (cm^3) **or** in cm^3 **or** cm^3 for **each** entry	**1**
	III All accurate burette readings are to the nearest 0.05 cm^3. *The requirement to record to 0.05 applies to burette readings, including 0.00 cm^3 (if this was the initial reading), but it does **not** apply to the titre.* *Do **not** award this mark if:* • *50(.00) is used as an initial burette reading* • *more than one final burette reading is 50.(00)* • *any burette reading is greater than 50.(00)*	**1**
	IV The final accurate titre recorded is within 0.10 cm^3 of any other accurate titre.	**1**
	Examiner rounds any accurate burette readings to the nearest 0.05 cm^3 and then selects the 'best' titres using the hierarchy: • two (or more) accurate identical titres, then • two (or more) accurate titres within 0.05 cm^3, then • two (or more) accurate titres within 0.10 cm^3 etc. These best titres should be used to calculate the mean corrected titre to the nearest 0.01 cm^3. Examiner compares candidate's titre value with that of the Supervisor:	

Question	Answer	Marks
1(a)	Award **V**, **VI** and **VII** if $\delta \leqslant 0.30$ (cm^3)	**1**
	Award **V** and **VI** if $0.30 < \delta \leqslant 0.60$	**1**
	Award **V**, only, if $0.60 < \delta \leqslant 1.00$	**1**
1(b)	Candidate calculates the mean correctly. • Candidate averages two (or more) titres where the total spread is $\leqslant 0.20\ cm^3$. • Working must be shown **or** ticks must be put next to the two (or more) accurate readings selected. • The mean should be quoted to 2 dp, and be rounded to nearest 0.01 cm^3. *(e.g. 26.666 cm^3 must be rounded to 26.67 cm^3)* Two special cases, where the mean need not be to 2 dp: • Allow mean to 3 dp **only** for 0.025 or 0.075 *(e.g. 26.325 cm^3)* • Allow mean to 1 dp, if **all** accurate burette readings were given to 1 dp **and** the mean is **exactly** correct. *(e.g. 26.0 and 26.2 = 26.1 is allowed)* *(e.g. 26.0 and 26.1 = 26.1 is wrong – should be 26.05)* *Do **not** award this mark if:* • *The rough titre was used to calculate the mean.* • *The candidate performed only one accurate titration.* • *Burette readings were incorrectly subtracted to obtain any of the accurate titre values.* • ***All** burette readings (resulting in titre values used in calculation of mean) are integers.* ***Note**: the candidate's mean will sometimes be marked correct even if it was different from the mean calculated by the Examiner for the purpose of assessing accuracy.*	**1**
1(c)(i)	Correctly calculates Number of moles of $S_2O_3^{2-}$ used = $0.150 \times \frac{\textbf{(b)}}{1000}$ Answer given to 3 or 4 sf	**1**
1(c)(ii)	Correctly calculates ans**(ii)** = ans**(i)** Answer given to 3 or 4 sf	**1**

Question	Answer	Marks
1(c)(iii)	Correct use ans**(ii)** / 0.0250 (or equivalent) Answer given to 3 or 4 sf	**1**
1(c)(iv)	Correct expression 32.5 / ans**(iii)** – 159.6	**1**
	Correct answer x = nearest integer to $\frac{[32.5 / \text{ans}\textbf{(iii)} - 159.6]}{18}$	**1**
1(d)(i)	Correct expression Use of $\frac{0.1(0)}{\text{any accurate titre}} \times 100$	**1**
1(d)(ii)	The volume from the burette has a smaller error / more precise	**1**
	FA 3 is in excess	**1**

Question	Answer	Marks
2(a)	**I** Table of data Must show all of the following: • mass of crucible (+ lid) • mass of crucible (+ lid) + **FA 5** • mass of crucible (+ lid) + residue • mass of **FA 5** • mass of residue • mass of water lost	**1**
	II Recording of data • Unit / g, (g) or in grams for all data recorded • all three balance readings recorded to same number of dp	**1**
	III Correctly calculates • mass of **FA 5**, • mass of residue, • mass of water lost	**1**
	Examiner checks supervisor's subtraction for mass of **FA 5** and mass of residue and calculates the ratio mass of **FA 5** ÷ mass of residue to 2 dp. Examiner compares candidate's value with that of Supervisor.	
	Award **IV** if $\delta \leqslant 0.10$	**1**
	Award **V** if $\delta \leqslant 0.05$	**1**
2(b)(i)	Correctly uses **(i)** = mass of residue / 208.3 Answer given to 2–4 sf	**1**
2(b)(ii)	Correctly calculates **(ii)** = mass of water lost / 18 Answer given to 2–4 sf	**1**
2(b)(iii)	Correctly calculates **(ii) ÷ (i) and y** as an integer	**1**

Question	Answer	Marks
2(c)(i)	Greater mass lost / smaller mass of residue / fewer moles of residue / greater mass of water (appears to be lost)	**1**
	so **y** would be greater	**1**
2(c)(ii)	heat to constant mass OWTTE **/** cooling in a desiccator	**1**

Question	Answer	Marks
	FA 6 is $MgSO_4.7H_2O$; **FA 7** is $CuCl_2.2H_2O$	
3(a)(i)	**FA 6** (Heating) produces water vapour / steam / moisture or condensation / solution / liquid forms / melts / dissolves **AND** **FA 7** (Heating) produces water vapour / steam / moisture or condensation / solution / liquid forms / melts	**1**
	FA 6 (stronger heating) gives a white solid/ residue **AND** **FA 7** a yellow / green / brown / black solid/ residue	**1**
	Gas / chlorine / Cl_2 from heating **FA 7** bleaches damp litmus paper **or** Gas / hydrogen chloride / HCl from heating **FA 7** turns litmus red.	**1**
3(a)(ii)	water	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(b)(i)</td><td>Clear presentation of results to show FA 6 and FA 7 and two or more reagents.</td><td>1</td></tr>
<tr><td></td><td>Uses NaOH(aq) and NH_3(aq).</td><td>1</td></tr>
<tr><td></td><td>
<table>
<tr><th></th><th>FA 6</th><th>FA 7</th></tr>
<tr><td>NaOH</td><td>white ppt and
no change / insoluble with excess</td><td>(pale / light) blue ppt and
no change / insoluble with excess</td></tr>
<tr><td>NH_3</td><td>white ppt and
no change / insoluble with excess</td><td>(pale) blue ppt and
dark / deep blue solution with excess</td></tr>
</table>
Two boxes correct for each mark.</td><td>2</td></tr>
<tr><td>3(b)(ii)</td><td>
<table>
<tr><td>test</td><td colspan="2">observations</td></tr>
<tr><td rowspan="2">+ $Ba^{2+}(aq)$</td><td>FA 6</td><td>FA 7</td></tr>
<tr><td>white ppt</td><td>no reaction / no ppt / no change</td></tr>
<tr><td>+ excess of HCl or HNO_3</td><td>insoluble</td><td>no reaction / no ppt / no change</td></tr>
<tr><td>+ $Ag^+(aq)$</td><td>no reaction / no ppt / no change</td><td>white ppt</td></tr>
</table>
Two boxes correct for each mark.</td><td>3</td></tr>
<tr><td>3(b)(iii)</td><td>FA 6 contains Mg^{2+} / magnesium and SO_4^{2-} / sulfate
FA 7 contains Cu^{2+} / copper(II) and Cl^- / chloride
1 mark for 2 correct ions</td><td>2</td></tr>
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