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CHEMISTRY **9701/33**

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

MARK SCHEME

Maximum Mark: 40

Published

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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:	

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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**

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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**

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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**

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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**

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<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>
</table>

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