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CHEMISTRY

9701/33

Paper 3 Advanced Practical Skills 1

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MARK SCHEME

Maximum Mark: 40

Published

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This document consists of **7** printed pages.

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>i.e.</i> 2×2 “box”)	1
	II Appropriate headings and units for accurate titration. and volume FA 1 added recorded for each accurate titre. <i>Headings should match readings.</i> - initial / start and (burette) reading / volume (<i>allow vol but not V</i>) - final / end and (burette) reading / volume - titre or volume / FA 1 and used/added (<i>but not “difference” or “total” or “change”</i>) 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 . <i>The requirement to record to 0.05 applies to burette readings, including 0.00 cm³ (if this was the initial reading), but it does not apply to the titre.</i> <i>Do not award this mark if:</i> 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 cm³, then - two (or more) accurate titres within 0.10 cm³ 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 $\delta \leq 0.30 \text{ cm}^3$	1
	Award V and VI if $0.30 < \delta \leq 0.60$	1
	Award V , only, if $0.60 < \delta \leq 1.00$	1
1(b)	Candidate calculates the mean correctly. • Candidate averages two (or more) titres where the total spread is $\leq 0.20 \text{ cm}^3$. • 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 $\text{Number of moles of } \text{S}_2\text{O}_3^{2-} \text{ used} = 0.150 \times \frac{(\text{b})}{1000}$ 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 $\frac{[32.5 / \text{ans(iii)} - 159.6]}{18}$	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 $\delta \leq 0.10$	1
	Award V if $\delta \leq 0.05$	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 $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$; FA 7 is $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$		
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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Question	Answer	Marks															
3(b)(i)	Clear presentation of results to show FA 6 and FA 7 and two or more reagents.	1															
	Uses NaOH(aq) and NH ₃ (aq).	1															
		2															
	<table><tr><td></td><td>FA 6</td><td>FA 7</td></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>NH₃</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>		FA 6	FA 7	NaOH	white ppt and no change / insoluble with excess	(pale / light) blue ppt and no change / insoluble with excess	NH ₃	white ppt and no change / insoluble with excess	(pale) blue ppt and dark / deep blue solution with excess							
	FA 6	FA 7															
NaOH	white ppt and no change / insoluble with excess	(pale / light) blue ppt and no change / insoluble with excess															
NH ₃	white ppt and no change / insoluble with excess	(pale) blue ppt and dark / deep blue solution with excess															
	Two boxes correct for each mark.																
3(b)(ii)		3															
	<table><tr><td><i>test</i></td><td colspan="2"><i>observations</i></td></tr><tr><td rowspan="2">+ Ba²⁺(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 HNO₃</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>		<i>test</i>	<i>observations</i>		+ Ba ²⁺ (aq)	FA 6	FA 7	white ppt	no reaction / no ppt / no change	+ excess of HCl or HNO ₃	insoluble	no reaction / no ppt / no change	+ Ag ⁺ (aq)	no reaction / no ppt / no change	white ppt	
	<i>test</i>		<i>observations</i>														
	+ Ba ²⁺ (aq)		FA 6	FA 7													
white ppt		no reaction / no ppt / no change															
+ excess of HCl or HNO ₃	insoluble	no reaction / no ppt / no change															
+ Ag ⁺ (aq)	no reaction / no ppt / no change	white ppt															
	Two boxes correct for each mark.																
3(b)(iii)	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	2															