

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the October/November 2014 series

9701 CHEMISTRY

9701/36

Paper 3 (Advanced Practical Skills 2),
maximum raw mark 40

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – October/November 2014	9701	36

Question	Indicative material	Mark	Total
1 (a)	<p>I The following data is shown</p> <ul style="list-style-type: none"> two burette readings for the rough titration titre for rough titration initial and final burette readings for two (or more) accurate titrations (<i>Minimum of 2 × 2 boxes</i>) <p><i>Correct headings and units for accurate titrations.</i> <i>Headings should match readings</i></p> <ul style="list-style-type: none"> <i>Initial/start and (burette) reading/volume (not V or vol)</i> <i>Final/end and (burette) reading/volume</i> <i>Titre or volume /FB 1 and used/added (not difference, total or change)</i> <p><i>Unit: /cm³ or (cm³) or in cm³ or cm³ for each reading.</i></p> <p>II All accurate burette readings are to nearest 0.05 cm³. The need to record to 0.05 cm³ applies to the burette readings and not to the recorded titres but it does apply to 0.00 cm³.</p> <p>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)</p> <p>III Has two uncorrected, accurate titres within 0.1 cm³</p> <p><i>Do not consider the ‘rough’ even if ticked.</i> <i>Do not award this mark if having performed two titres within 0.1 cm³ a further titration is performed which is more than 0.10 cm³ from the closer of the initial two titres, unless any further titrations, within 0.1 cm³ of any other titration have also been carried out.</i> <i>Do not award this mark if any accurate burette readings (apart from initial 0) are given to zero dp.</i></p>	1 1 1	
	<p>Round any burette readings to the nearest 0.05 cm³. Examiner selects the ‘best’ titres using the hierarchy:</p> <ul style="list-style-type: none"> two (or more) accurate identical titres (ignoring rough), then two (or more) accurate titres within 0.05 cm³, then two (or more) accurate titres within 0.10 cm³ etc <p>These best titres should be used to calculate the mean corrected titre to the nearest 0.01 cm³.</p>		
	<p>Award IV, V and VI if $\delta < 0.2 \text{ cm}^3$ Award IV and V if $\delta > 0.2$ but $< 0.3 \text{ cm}^3$ Award IV if $\delta > 0.3 \text{ cm}^3$ but $< 0.4 \text{ cm}^3$. Spread penalty: if the two best (corrected) titres used by the examiner were $> 0.5 \text{ cm}^3$ apart, cancel one Q mark.</p>	1 1 1	
			[6]

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – October/November 2014	9701	36

(b)	<p>Calculation of mean Candidate must average two (or more) accurate titres with total spread of no more than 0.2 cm³</p> <p>Working must be shown or ticks must be put next to the two (or more) accurate readings selected.</p> <p><i>The mean should normally be quoted to 2 dp rounded to the nearest 0.01. Example: 26.667 must be rounded to 26.67.</i></p> <p><i>Two special cases where the mean may not be to 2 dp: allow mean to 3 dp only for 0.025 or 0.075, e.g. 26.325; 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 correct but 26.0 and 26.1 = 26.1 is incorrect.</i></p> <p><i>Do not award this mark if: any selected titre is not within 0.20 cm³ of any other selected titre; the rough titre was used to calculate the mean; the candidate carried out only 1 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.</i></p> <p><i>Note: the candidate's mean will sometimes be marked as correct even if it is different from the mean calculated by the examiner for the purpose of assessing accuracy.</i></p>	1	[1]
(c) (i)	$M_r \text{KIO}_3 = 214$	1	
	$\text{Moles dm}^{-3} = \frac{3.60}{40 \times 214} = 4.205/4.206/4.21/4.21 \times 10^{-4}$	1	
(ii)	$\text{Moles S}_2\text{O}_3^{2-} = (\text{i}) \times 6 = (2.52 \times 10^{-3})$	1	
(iii)	$\frac{(\text{ii}) \times 1000}{\text{vol from (b)}}$	1	
	Answers given to 3 or 4 sf	1	[5]
[Total: 12]			
2 (a)	<p>Round times to nearest second. Supervisor calculates time with 10 cm³ / time with 20 cm³ (to 1 dp) and</p> <p>awards 3 marks if within 1.9 to 2.1 awards 2 marks if within 1.8 to 2.2 (but not within 1.9 to 2.1) awards 1 mark if within 1.6 and 2.4 (but not within 1.8 to 2.2)</p>	1 1 1	[3]
(b)	I 3 additional volumes chosen with intervals not less than 2 cm ³ . These must include 1 of < 10 cm ³ and 1 of > 10 cm ³ and have none < 4 cm ³ .	1	

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – October/November 2014	9701	36

	<p>II In all 3 additional experiments water is added to make a total of 20 cm³.</p> <p>III Tables in (a) and (b) to show volume FB 5, volume water and reaction time. All volumes measured to 0.05 cm³.</p> <p>IV All times recorded to nearest second.</p>	1	
		1	
		1	[4]
(c)	Completes table correctly.	1	
	Correct headings and units including cm ³ s.	1	[2]
(d)	Agree: product FB5 × reaction time is (approx) constant	1	
	Or		
	Disagree: product of FB5 × reaction time is not constant		[1]
(e)	sodium thiosulfate is in excess – all the iodine reacts with the thiosulfate so no iodine produced (to turn blue-black).	1	[1]
(f)	(Carry out a series of reactions) keeping volume S₂O₈²⁻ (FB5) constant (and timing to blue-black)	1	
	Alter volume I ⁻ (FB4) but keep total volume (I ⁻ and water) constant / keep I ⁻ and water volumes constant but change concentration of I ⁻ .	1	[2]
			[Total: 13]

Page 5	Mark Scheme	Syllabus	Paper
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FB 7 is $MnCl_2$, FB 8 is $KMnO_4$, FB 9 is $CuCO_3$, FB 10 is $CuSO_4$

3	(a) (i)	White ppt	1	
	(ii)	Off-white / buff / beige / light brown ppt and darkens on standing / insoluble in excess.	1	
	(iii)	Brown / black colour	1	
	(iv)	Effervescence / bubbling / fizzing and relights glowing splint	1	
		(Colour change) purple / pink to colourless	1	[5]
(b)	Manganese	1	[1]	
3	(c) (i)	(Solid goes) black	1	
	(ii)	Fizz / effervescence / bubbling and blue solution.	1	
		Limewater turns milky	1	
	(iii)	Any three from	2	
		Solution goes paler		
		Pink / black / brown solid formed		
		Solution gets warmer		
	Fizz			
	Pop with lighted splint			
	3 correct answers scores 2			
	2 correct answers scores 1			
(iv)	Solution turns / goes yellow / green	1		
(v)	Copper / Cu^{2+}	1		
(vi)	0 to (+)2	1	[8]	
(e)	Transition (elements) / d-block	1	[1]	
			[Total: 15]	