

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

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.

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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)	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>Minimum of 2×2 boxes</i>) <i>Correct headings and units for accurate titrations.</i> <i>Headings should match readings</i> • Initial/start and (burette) reading/volume (not V or vol) • Final/end and (burette) reading/volume • Titre or volume/FB 1 and used/added (not difference, total or change) <i>Unit: /cm³ or (cm³) or in cm³ or cm³ for each reading.</i>	1	
	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. 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	
	III Has two uncorrected, accurate titres within 0.1 cm³ <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>	1	
	Round any burette readings to the nearest 0.05 cm³. Examiner selects the 'best' titres using the hierarchy: • 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 These best titres should be used to calculate the mean corrected titre to the nearest 0.01 cm³.		
	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.	1 1 1	[6]

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

(b)	Calculation of mean Candidate must average two (or more) accurate titres with total spread of no more than 0.2 cm³ Working must be shown or ticks must be put next to the two (or more) accurate readings selected. <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> <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> <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> <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>	1	[1]
(c) (i)	$M_r \text{ KIO}_3 = 214$ Moles dm⁻³ = $\frac{3.60}{40 \times 214} = 4.205/4.206/4.21/4.21 \times 10^{-4}$	1	
		1	
(ii)	Moles S ₂ O ₃ ²⁻ = (i) × 6 = (2.52 × 10 ⁻³)	1	
(iii)	$\frac{\text{(ii)} \times 1000}{\text{vol from (b)}}$ Answers given to 3 or 4 sf	1	[5]
[Total: 12]			
2 (a)	Round times to nearest second. Supervisor calculates time with 10 cm³ / time with 20 cm³ (to 1 dp) and 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)	1 1 1	[3]
(b)	I 3 additional volumes chosen with intervals not less than 2 cm³. These must include 1 of < 10 cm³ and 1 of > 10 cm³ and have none < 4 cm³.	1	

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

	II In all 3 additional experiments water is added to make a total of 20 cm ³ . III Tables in (a) and (b) to show volume FB 5 , volume water and reaction time. All volumes measured to 0.05 cm ³ . IV All times recorded to nearest second.	1 1 1	 [4]
(c)	Completes table correctly. Correct headings and units including cm ³ s.	1 1	 [2]
(d)	Agree: product FB5 × reaction time is (approx) constant Or Disagree: product of FB5 × reaction time is not constant	1	 [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) Alter volume I ⁻ (FB4) but keep total volume (I ⁻ and water) constant / keep I ⁻ and water volumes constant but change concentration of I ⁻ .	1 1	 [2]
[Total: 13]			

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – October/November 2014	9701	36

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]
	(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]