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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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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 (*Minimum of 2 × 2 boxes)* *Correct headings and units for accurate titrations.* *Headings should match readings* • *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)* *Unit:/cm^3 or (cm^3) or in cm^3 or cm^3 for each reading.*	1	
	II All **accurate** burette readings are to nearest 0.05 cm^3. The need to record to 0.05 cm^3 applies to the burette readings and not to the recorded titres but it does apply to 0.00 cm^3. 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 cm^3 *Do **not** consider the 'rough' even if ticked.* *Do **not** award this mark if having performed two titres within 0.1 cm^3 a further titration is performed which is more than 0.10 cm^3 from the closer of the initial **two** titres, unless any further titrations, within 0.1 cm^3 of any other titration have also been carried out.* *Do **not** award this mark if any accurate burette readings (apart from initial 0) are given to **zero** dp.*	1	
	Round any burette readings to the nearest 0.05 cm^3. 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 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.		
	Award **IV**, **V** and **VI** if $\delta < 0.2\ cm^3$ Award **IV** and **V** if $\delta > 0.2$ but $< 0.3\ cm^3$ Award **IV** if $\delta > 0.3\ cm^3$ but $< 0.4\ cm^3$. Spread penalty: if the two best (corrected) titres used by the examiner were $> 0.5\ cm^3$ apart, cancel one Q mark.	1 1 1	[6]

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	(b)	**Calculation of mean** Candidate must average two (or more) accurate titres with total spread of no more than 0.2 cm^3 Working must be shown or ticks must be put next to the two (or more) accurate readings selected. *The mean should normally be quoted to 2 dp rounded to the nearest 0.01. Example: 26.667 must be rounded to 26.67.* *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.* *Do **not** award this mark if:* *any selected titre is not within 0.20 cm^3 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.* *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.*	1	[1]
	(c) (i)	M_r KIO_3 = 214	1	
		Moles dm^{-3} = $\frac{3.60}{40 \times 214}$ = $4.205 / 4.206 / 4.21 / 4.21 \times 10^{-4}$	1	
	(ii)	Moles $S_2O_3^{2-}$ = **(i)** × 6 = (2.52×10^{-3})	1	
	(iii)	$\frac{\textbf{(ii)} \times 1000}{\text{vol from } \textbf{(b)}}$	1	
		Answers given to 3 or 4 sf	1	[5]
				[Total: 12]
2	**(a)**	Round times to nearest second. Supervisor calculates time with 10 cm^3 / time with 20 cm^3 (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 cm^3. These must include 1 of < 10 cm^3 and 1 of > 10 cm^3 and have none < 4 cm^3.	1	

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	II In all 3 additional experiments water is added to make a total of 20 cm^3.	1	
	III Tables in **(a)** and **(b)** to show volume **FB 5**, volume water and reaction time. All volumes measured to 0.05 cm^3.	1	
	IV All times recorded to nearest second.	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 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** $S_2O_8^{2-}$ **(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]

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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]
(c) (i)	(Solid goes) black	1	
(ii)	Fizz / effervescence / bubbling **and** blue solution.	1	
	Limewater turns milky	1	
(iii)	Any **three** from 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	2	
(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]

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