CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2014 series

9701 CHEMISTRY

9701/31 Paper 3 (Advanced Practical Skills 1), 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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2014 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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Question	Sections	Indicative material	Mark	Total
1 (a)	PDO Layout	**I** Initial and final readings and titre value given for rough titre **and** initial and final readings for two (or more) accurate titrations (*minimum of 2 × 2 box*)	1	
	PDO Recording	**II** Appropriate headings and units for all accurate data. **and** volume **FA 1** added recorded for each accurate titre. *Headings should match readings.* • initial/start (burette) reading/volume • final/end (burette) reading/volume • titre **or** volume/**FA 1** used/added *(**not** "difference")* unit: /cm^3 **or** (cm^3) **or** in cm^3 **or** cm^3 for **each** entry	1	
		III All accurate burette readings recorded to 0.05 cm^3. *The need to record to 0.05 applies only to the burette readings and **not** to the recorded titres.* *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	
	MMO Decisions	**IV** Has two uncorrected, accurate titres within 0.1 cm^3 *Do not include a reading labelled 'rough'.* *Do **not** award this mark if, having performed two titres within 0.1 cm^3, a further titration is performed that is more than 0.1 cm^3 from the closer of the two initial titres unless further titrations within 0.1 cm^3 of any other have also been carried out.* *Do **not** award the mark if any 'accurate' burette readings (apart from initial 0) are given to **zero** dp.*	1	
Examiner rounds burette readings to the nearest 0.05 cm^3, checks subtractions and then selects the 'best' titres using the hierarchy: two (or more) identical, then two (or more) within 0.05 cm^3, then two (or more) within 0.1 cm^3, etc. Examiner compares candidate mean titre with Supervisor mean titre.				
(a)	MMO Quality	Award **V** and **VI** for difference from Supervisor, $\delta \leq 0.20\,cm^3$ Award **V** only for $0.20 < \delta \leq 0.40\,cm^3$ *Spread penalty: if the two 'best' titres are ≥ 0.50 cm^3 apart cancel one of the Q marks.*	2	[6]

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Question	Sections	Indicative material	Mark	Total
(b)	ACE Interpretation	Candidate must average two (or more) titres that are within 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 normally be quoted to 2 dp rounded to the nearest 0.01.* *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.* *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)	ACE Interpretation	**I** Correctly evaluates $\frac{0.0200 \times \textbf{(b)}}{1000}$ in **(i)**	1	
		II Correctly evaluates $\frac{\textbf{(i)} \times 5/2}{25}$ in **(iii)**	1	
	PDO Display	**III** Correct balanced equation in **(iv)**	1	
	ACE Interpretation	**IV** Correctly evaluates ans **(iii)** × ½ × 24.0 in **(v)** (Allow ecf from incorrect equation)	1	
	PDO Display	**V** All answers given to 3 or 4 sf (minimum of 3 answers attempted)	1	[5]
Qn 1	**Total**		**[12]**	

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Question	Sections	Indicative material	Mark	Total
2 (a)	PDO Recording	**I** Table to include • volume of hydrogen peroxide/**FA 2**, • volume of potassium iodide/**FA 4**, • volume of distilled water, • reaction time. volume/V in cm^3//cm^3/ (cm^3), time/t in seconds//s/(s). (Minimum 2 expts recorded)	1	
		II All times recorded to the nearest second. (Minimum 2 expts)	1	
	ACE Interpretation	**III** Correctly calculates all three rates (allow to 2 or 3 sf)	1	
		Compare times for Expts 1 and 3 with those of the Supervisor.		
	MMO Quality	Award **IV**, **V** and **VI** for both times within 3 s Award **IV** and **V** for one within 3 s and one within 6 s Award **IV** only for either within 6 s (If only 2 expts carried out **IV** is available – from either expt performed)	3	[6]
(b)	ACE Conclusion	Rate increases with increasing concentration of hydrogen peroxide and potassium iodide (ora). Allow ecf from candidate's results.	1	[1]
(c)	MMO Decisions	Selects different volumes of **FA 4** (less than 20 cm^3, not 10 cm^3 and not closer than 2 cm^3 to suggested volumes or to 20 cm^3 or to 10 cm^3)	1	
		Volumes of distilled water selected so that vol of water + vol of **FA 4** = 20 cm^3 **and FA 2** = 20 cm^3 If **FA 3** and **FA 5** are shown then the volumes must be constant.	1	[2]
(d)	ACE Improvements	Reason: change of temperature Use water bath to maintain constant temperature	1	
		Reason: decomposition of hydrogen peroxide Store H_2O_2(aq) in the fridge, make up fresh H_2O_2(aq), check conc. of H_2O_2(aq), keep H_2O_2(aq) in dark/dim light.	1	[2]
(e) (i)	ACE Interpretation	Expression $\frac{1}{\text{time from Expt 1}} \times 100$ **or** correct value.	1	
(ii)		(Higher conc. of thiosulfate means) greater reaction time (allow reaction will be slower) **and** so a smaller percentage error.	1	[2]
Qn 2	**Total**		**[13]**	

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Question	Sections	Indicative material	Mark	Total
FA 6 is $ZnSO_4(aq)$ and NaBr(aq); **FA 7** is $FeSO_4(aq)$				
3 (a) (i)	MMO Decisions	**I** Selects NaOH(aq) and $NH_3(aq)$, and uses each in excess	1	
	PDO Layout	**II** Unambiguous layout of all 4 observations (excess must be stated).	1	
	MMO Collection	**III** White ppt with NaOH and soluble in excess.	1	
		IV White ppt with NH_3 soluble in excess.	1	
	ACE Conclusion	**V** Zn^{2+}	1	
(ii)	MMO Collection	**VI** Cream ppt with $AgNO_3$ **and** partially sol / insol in NH_3	1	
		VII White ppt with $BaCl_2/Ba(NO_3)_2$ **and** insol in nitric acid.	1	
	ACE Conclusion	**VIII** Br^-	1	
		IX SO_4^{2-}	1	[9]
(b) (i)	MMO Collection	**I** Green ppt turning brown (in contact with air)	1	
(ii)		**II** No reaction/no change **or** yellow or green solution	1	
(iii)		**III** Red-brown/brown/green-brown ppt **and** effervescence	1	
		IV Gas relights a glowing splint	1	
(iv)	ACE Conclusion	**V** Redox	1	
(v)		**VI** Decomposition of hydrogen peroxide to give oxygen **or** ppt is $Fe(OH)_3$ / oxidation of Fe^{2+} to Fe^{3+}	1	[6]
Qn 3	**Total**		**[15]**	

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