CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2014 series

9701 CHEMISTRY

9701/34 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.

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** Unambiguous headings for 2 balance readings **and** volume of **FB 2** added between 47.5 and 48.5 cm^3	1	
	MMO Collection	**II** 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	**III** Appropriate headings and units for all accurate data. **and** volume **FB 3** added recorded for each accurate titre. *Headings should match readings.* • initial/start (burette) reading/volume • final/end (burette) reading/volume • titre **or** volume/**FB 3** used/added *(**not** "difference")* unit: /cm^3 **or** (cm^3) **or** in cm^3 **or** cm^3 for **each** entry	1	
	MMO Decisions	**IV 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	
		V 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 has also been carried out.* *Do **not** award the 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. Check and correct subtractions in the titre table. Examiner then selects the "best" titre using the hierarchy: two identical; titres within 0.05 cm^3; titres within 0.1 cm^3; etc. Candidate scaled titre calculated as: Scaled titre = $\frac{\text{Cand titre} \times \text{Cand}\{(V_{added}/500) - 1.6 \times \text{mass}/100.1)\}}{\text{Supervisor}\{(V_{added}/500) - 1.6 \times \text{mass}/100.1)\}}$ Examiner compares candidate scaled titre with Supervisor's titre.				
(a)	MMO Quality	Award **VI**, **VII**, **VIII** and **IX** for $\delta \leq 0.40\,cm^3$ Award **VI, VII** and **VIII** for $0.40\,cm^3 < \delta \leq 0.80\,cm^3$ Award **VI** and **VII** for $0.80\,cm^3 < \delta \leq 1.20\,cm^3$ Award **VI** only for $1.20\,cm^3 < \delta \leq 2.00\,cm^3$ *If the "best" titres are ≥ 0.50 cm^3 apart cancel one of the Q marks.*	4	[9]

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Question	Sections	Indicative material	Mark	Total
(b)	ACE Interpretation	Candidate must average two (or more) titres that are all 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) **(i)&(ii)**	ACE Interpretation	**I** Correctly calculates $\frac{0.200 \times 25}{1000} = 5 \times 10^{-3}$ in **(i)** **and** gives 5×10^{-3} in **(ii)**	1	
(iii)		**II** Uses **(ii)** $\times \frac{250}{\textbf{(b)}}$ in **(iii)**	1	
(iv)		**III** Correct expression $\frac{2.00 \times \text{V diluted}}{1000}$ in **(iv)**	1	
		IV Correct expressions **(iv)** – **(iii)** in **(v)** **and** **(v)** ÷ 2 in **(vi)**	1	
		V (vi) × 100.1 (allow × 100) in **(vii)**	1	
(v)&(vi)		**VI** (answer ÷ correct mass **FB 1**) × 100 in **(vii)**	1	
(vii) **(*2 marks*)**	PDO Display	**VII** Answers to steps **(iii)** to **(vii)** given to 3 or 4 sf *minimum number of steps attempted = 4 to access this mark*	1	[7]
(d) (i)	ACE Interpretation	smallest = 48.40, largest = 48.60	1	
(ii)	Conclusion	Correct link between volume of **FB 2** used/in excess/ concentration of remaining **FB 2** and titre **or** between concentration/volume **FB 3**/HCl remaining/in excess and titre. (higher volume/concentration gives smaller titre ora)	1	
		Correct reference to student(s) X and/or Y	1	[3]
Qn 1	**Total**		**[20]**	

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Question	Sections	Indicative material	Mark	Total
2 (a)	PDO Recording	Headings with units for all four balance readings are tabulated clearly. • mass of crucible • mass of crucible + **FB 5** • mass of crucible + contents/residue/solid/**FB5** after heating/cooling • mass of crucible + contents/residue/solid/**FB5** after re-heating/re-cooling/2nd heating/2nd cooling Mass /g, (g), in g, in grams *If units are omitted from the headings then they must appear next to each entry in the table.*	1	
		Records all balance readings to a consistent number of dp (minimum 1 dp and minimum 3 balance readings) **and** records mass of **FB 5** (at start) and mass of solid remaining owtte Headings for the two masses of solid must be unambiguous.	1	[2]
(b) (i)	ACE Interpretation	Correct mass loss from results in **(a)**	1	
(ii)	PDO Display	Shows correct use of 100.1 and 44: $\frac{\textbf{(i)} \times 100.1}{44}$	1	
(iii)	ACE Interpretation	calculates $\frac{\text{ans } \textbf{(ii)}}{\text{mass } \textbf{FB 5}} \times 100$	1	[3]
(c) (i)	ACE Conclusion	Thermal decomposition is less accurate because not all carbonate has decomposed. Temperature used not high enough to decompose solid Percentage of $CaCO_3$ is much less in **Question 2**	1	
(ii)	Improvement	Heat to constant mass. Use a gas/Bunsen burner/furnace	1	
		If candidates achieve constant mass and give titration less accurate as more steps then award 1 mark.		[2]
Qn 2	**Total**		**[7]**	

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Question	Sections	Indicative material	Mark	Total
FB 6 is $MgSO_4$ + HNO_3(aq); **FB 7** is $ZnCO_3$(s) + KI(s)				
3 (a)	MMO Collection	**I** White ppt with NH_3 insoluble in excess	1	
		II No visible reaction/no change **and** White ppt	1	
	ACE Conclusion	**III** Mg^{2+} **and** Al^{3+} **and** SO_4^{2-} and/or SO_3^{2-} in **(iv)**	1	
	MMO Decisions	**IV** Selects NaOH in **(v)**. (*Allow KI/ HCl/ H_2SO_4/K_2CrO_4 if Pb^{2+} in **(iv)***)	1	
	Collection	**V** White ppt insoluble in excess (NaOH) (*Allow no reaction with KI if Pb^{2+} in **(iv)***)	1	
	ACE Conclusion	**VI** (not) Al^{3+} / Mg^{2+} is present Allow ecf from incorrect <u>cations</u> in **(iv)** and correct observation with NaOH	1	[6]
(b) (i)	MMO Collection	**I** Solid turns yellow on heating **and** paler yellow/white on cooling	1	
(ii)		**II** Effervescence **and** gas turns limewater milky (or in **(i)**)	1	
(iii)		**III** (Solution turns) (darker) yellow/orange/red/brown **and** blue/black with starch	1	
(iv)		**IV** (Pale) yellow ppt	1	
(v)	ACE Conclusion	**V** White ppt soluble in excess	1	
		VI and **VII**	1	
		Identifies all three ions (Zn^{2+}, CO_3^{2-} and I^-)	1	
		VI only Identifies two ions. Minimum evidence: Zn^{2+} white ppt soluble in excess NH_3 CO_3^{2-} effervescence or positive limewater I^- either **(iii)** or **(iv)** correct		[7]
Qn 3	**Total**		**[13]**	

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