CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2014 series

9701 CHEMISTRY

9701/32 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.

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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 **FB 1** added recorded for each accurate titre. *Headings should match readings.* • initial/start (burette) reading/volume • final/end (burette) reading/volume • titre **or** volume/**FB 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	
All burette readings should be rounded to the nearest 0.05 cm^3. Subtractions should be checked. The 'best' titres should be selected 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	**V, VI** and **VII** Award **V**, **VI** and **VII** for a difference from Supervisor, $\delta \leq 0.20\ cm^3$ Award **V** and **VI** for $0.20 < \delta \leq 0.30\ cm^3$ Award **V** only for $0.30 < \delta \leq 0.50\ cm^3$ *Spread penalty: if the two 'best' titres are ≥ 0.50 cm^3 apart cancel one of the Q marks.*	3	[7]

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Question	Sections	Indicative material	Mark	Total
(b)	MMO Decisions	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 calculates $\frac{\textbf{(b)} \times 0.100}{1000}$ in **(i)** **and** gives ans **(i)** $\times$ 40 in **(iii)** (both answers to 3 or 4 sf)	1	
	PDO Display	**II** Gives correct equation in **(ii)** $H^+ + HCO_3^- \rightarrow H_2O + CO_2$ (allow H_2CO_3)	1	[2]
Qn 1	**Total**		**10**	

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Question	Sections	Indicative material	Mark	Total
2 (a)	PDO Display	**I** Shows clearly mass of empty crucible, mass of crucible + **FB 3**, mass of crucible and residue with correct units. (mass/g or (g) or in g)	1	
	Recording	**II** Records all weighings consistently to at least 1 dp and records the correctly calculated mass of **FB 3** used and water lost. *Units must be correct and headings must be unambiguous.*	1	
	MMO Quality	Calculate mass of water lost/mass of **FB 3** to 2 dp and compare with Supervisor value. Award **III** and **IV** if $\delta \leq 0.05$ Award **IV** only if $0.05 < \delta \leq 0.08$	2	[4]
(b) (i)	ACE Interpretation	**I** $\frac{\text{mass water lost}}{18}$ (expression) **or** correct moles of water Final answer must be to 2 to 4 sf	1	
		II moles of water divided by 10 or correct answer	1	
		III M_r in **(ii)** from mass/ans **(i)**	1	
(ii)		**IV** Calculates A_r of **M** $A_r = \frac{M_r - 240}{2}$	1	
(iii)	Conclusion	**V** Choice of identity of **M** corresponds to nearest A_r	1	[5]
(c)	ACE Interpretation	0.1 or 0.2 for 1 dp balance, 0.01 or 0.02 for 2 dp balance, 0.001 or 0.002 for 3 dp balance in **(i)** **and** $\frac{\textbf{(i)} \times 100}{\text{mass of water}}$ in **(ii)** (expression or correct answer)	1	[1]
(d)	ACE Improvement	Problem and appropriate improvement required. Not all the water was lost (1) so heat to constant mass (1) Water was regained on cooling (1) so cool in a desiccator/ with a lid (1) Use a balance with more dp (1) this gives a lower **percentage** error (1) The solid frothed/spat on heating (1) so use a deeper crucible/heat **even more** gently (1) Small amount of solid used gives high **percentage** error (1) use more solid.	2	[2]
Qn 2	**Total**		**[12]**	

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Question	Sections	Indicative material	Mark	Total
FB 4 is $MgSO_4$; **FB 5** is $C_6H_{12}O_6$(aq) reacts as ethanal; **FB 6** is H_2O reacts as propanone; **FB 7** is C_2H_5OH; **FB 8** is HCOOH(aq)				
3 (a) (i)	MMO Decisions	**I** Selects NaOH and NH_3, and uses each in excess.	1	
	PDO Layout	**II** Unambiguous layout of all 4 observations.	1	
	MMO Collection	**III** White ppt with NaOH and insoluble in excess.	1	
		IV White ppt with NH_3 and insoluble in excess.	1	
	ACE Conclusion	**V** Mg^{2+}	1	
(ii)	MMO Decisions	**VI** Selects barium chloride/barium nitrate and hydrochloric/ nitric acid.	1	
	Collection	**VII** White ppt. **OR** **VI** selects acidified potassium manganate(VII) **VII** no reaction/stays purple/purple solution formed **OR** **VI** add a named acid and test for sulfur dioxide **VII** negative test	1	
	ACE Conclusion	**VIII** SO_4^{2-}	1	[8]
(b) (i)	MMO Collection	**I FB 5** and Tollens': silver mirror/black or brown or grey ppt	1	
		II FB 7 and manganate(VII): colour change purple to colourless/decolourised	1	
		III No reaction for **FB 6** with both reagents **and FB 7** with Tollens'	1	
(ii)	ACE Conclusion	**IV FB 6** is propanone (with no reactions observed)	1	
		V FB 5 and **FB 7** identified	1	
(iii)	MMO Decisions	**VI** Selects 2,4-DNPH	1	
	ACE Conclusion	**VII** Red/orange/yellow ppt for **FB 5** and **FB 6** and no change for **FB 7** ecf from identities in **(ii)**	1	[7]

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Question	Sections	Indicative material	Mark	Total
(c)	MMO Collection	Decolourises $KMnO_4$ Effervescence/fizzing/bubbles Turns limewater milky	1 1 1	[3]
Qn 3	Total		[18]	

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