CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2013 series

9701 CHEMISTRY

9701/31 Paper 31 (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.

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Question	Sections	Indicative material	Mark
1 (a)	PDO layout	**I** Constructs a table for results with space for 10 volumes.	1
	PDO recording	**II** Appropriate headings and units for data given. Volumes in cm^3 or / cm^3 or (cm^3), temperature in °C or /ºC or (ºC) in table. All volumes to same dp.	1
	PDO recording	**III** All temperatures recorded to the nearest 0.5 °C both in the table and for T_1. At least one ending in .0 and one in .5.	1
	MMO quality	**IV** + **V** Compare temp rise for addition of 25 cm^3 of **FA 2** with the Supervisor value. Award 2 marks for ΔT within ± 1 °C. Award 1 mark for ΔT within ± 2 °C.	2 [5]
(b)	ACE interpretation	Correctly calculates ΔT, V_T and $\Delta T \times V_T$ (assume correct data from **(a)**) (min 8 results)	1 [1]
(c) (i)	PDO layout	**I** $\Delta T \times V_T$ on *y-axis* and volume of **FA 2** on *x-axis*. Axes clearly labelled (ignore units).	1
		II Uniform scales chosen to use more than half of each axis. Only include 0 if point plotted. Points plotted use 5 large squares vertically and 4 horizontally.	1
		III All points plotted. Examiner to check points at V = 5, 10, 15, 20 and 25. The points should be within ½ small square and in correct small square. Min 8	1
(c) (ii)		**IV** Draws both straight lines of best fit.	1
(c) (iii)	ACE interpretation	Reads correctly the value of **FA 2** from the intercept of the two lines. Answer within 0.5 cm^3. Ignore sf.	1 [5]
(d) (i)		0.0500 mol (Allow 0.050)	1
(d) (ii)		0.0250 mol (allow 0.025) Allow ecf from **(i)**/2	1
(d) (iii)		1000 × **(d)(ii)** / **(c)(iii)** (2–4 sf) Allow ecf from **(ii)**. Penalise sf once only.	1 [3]

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(e)	ACE improvements	Accuracy of temperature measurement – use a 0 to 50 °C thermometer or a thermometer with smaller scale divisions (not just more accurate/ electronic thermometer/parallax). Uncertainty about where the lines cross – sample more values of **FA 2** in the region of the intersection. Repeat/ extra readings on LHS of intersection/ near maximum. Initial temperatures of acid and alkali not same – measure both. Other answers acceptable if **specific**.	1 [1]
			[Total: 15]
2 (a)	MMO collection	**I** Initial and final volumes recorded for rough AND initial, final and volume added recorded for accurate titre.	1
	PDO recording	**II** All accurate readings recorded to 0.05 cm^3. *Do not award 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.(0).*	1
	MMO decision	**III** Two uncorrected accurate titres within 0.1 cm^3. *Do not award if, having performed 2 titres within 0.1 cm^3, a further titration is performed that is >0.1 cm^3 from the closer of the original 2 titres unless a further titration has been carried out which is within 0.1 cm^3 of any other.*	1
	MMO quality	**IV** + **V** Award 2 marks if difference from Supervisor within 0.20 cm^3. Award 1 mark if difference from Supervisor within 0.50 cm^3. Examiner compares candidate mean titre with Supervisor mean titre. If best titres are ≥ 0.5 cm^3, cancel one of the Q marks.	2 [5]

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(b)	ACE interpretation	Calculates the mean to appropriate decimal places. *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. eg 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 PDO display PDO display	All answers correct. **(i)** 0.15 × **(b)** /1000 **(ii)** **(i)**/2 **(iii)** **(ii)** × 400 Working shown in **(i)** and **(iii)** All answers given to 3 or 4 sig figs (minimum 2).	1 1 1 [3]
(d)	ACE interpretation	Correctly works out % difference to min 2 sig figs.	1 [1]
			[Total: 10]

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FA 5 = HC*l* **FA 6** = $Pb(NO_3)_2$ **FA 7** = K_2CrO_4 **FA 8** = Na_2CO_3 **FA 9** = KBr

3 (a)	MMO collection	**I** **FA 5** and **FA 6**: a white ppt insoluble in excess	1
		II **FA 5** and **FA 7**: **solution turns from** yellow or colourless to orange	1
		III **FA 5** and **FA 8**: bubbles or effervescence	1
	MMO decisions	**IV** Uses limewater to test for gas and result.	1
	ACE conclusion	**V** Identifies gas as CO_2.	1
	MMO collection	**VI** **FA 6** and **FA 7**: a yellow ppt (insol in excess)	1
		VII **FA 6** and **FA 8**: a white ppt (insol in excess)	1
		VIII **FA 7** and **FA 8**: no reaction/ colourless to yellow (solution)	1 [8]
(b)	ACE conclusion	Pb^{2+} | C*l*$^-$ | CO_3^{2-} | CrO_4^{2-} **FA 6** | **FA 5** | **FA 8** | **FA 7** 4 correct scores 2 marks 3 correct scores 1 mark	2 [2]
(c)	ACE conclusion	H^+ because of colour change with chromate or CO_2 / gas released with carbonate.	1 [1]
(d) (i)	ACE conclusion	No as $PbBr_2$ / lead bromide is also a white ppt / gives the same observation (if correct in table).	1
(d) (ii)	MMO decision	Add $AgNO_3$ followed by NH_3.	1
	MMO collection	Cream ppt partially soluble or insoluble in ammonia/ soluble in conc. NH_3.	1
	ACE conclusion	**Bromide / Br** can be allowed from 'off white / buff'.	1 [4]
			[Total: 15]

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