CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2012 series

9701 CHEMISTRY

9701/36 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 October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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Question	Section	Indicative material	Mark	Total
1 (a)	PDO Layout	**I** Records initial and final burette readings and titre for rough. Tabulates and records initial and final burette readings and volume of **FB 2** run from burette for all accurate titrations. Not awarded if 50/50.0/50.00 shown more than once.	1	
	PDO Recording	**II** Appropriate headings and units: initial/final (burette) reading/volume, reading or volume at start/finish/beginning/end, volume used/volume added/**FB 2** used/titre. Units are /cm^3, (cm^3) or volume in cm^3.	1	
	PDO Recording	**III** All accurate burette readings recorded to 0.05 cm^3 (this includes 0.00). Two (minimum) accurate titrations needed.	1	
	MMO Quality	Difference between candidate's mean titre and Supervisor's is calculated. Award **IV, V** and **VI** for $\delta \leqslant 0.20\,cm^3$ Award **IV** and **V** for $0.20\,cm^3 < \delta \leqslant 0.40\ cm^3$ Award **IV** for $0.40\,cm^3 < \delta \leqslant 0.60\ cm^3$ **Spread penalty** Titres (selected by Examiner) differ by $\geqslant 0.5\,cm^3$ or only 1 accurate titration penalty -1. This mark is deducted from those awarded in IV to VI but no negative marks.	3	[6]
(b)	PDO Display	Calculation of mean Candidate must average two (or more) accurate titres that are within 0.20 cm^3 of another. 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 decimal places rounded to the nearest 0.01. Example: 26.667 must be rounded to 26.67. 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. 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]

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(c) (i)	ACE Interpretation	$\frac{0.1 \times \text{answer to (b)}}{1000}$ calculated correctly (3 to 4 significant figures)	1	
(ii)		Answer to **(c)(i)** (at least 2 significant figures)	1	
(iii)		$\frac{\text{Answer to (c)(ii)} \times 1000}{25.0}$ calculated correctly (3 to 4 significant figures)	1	[3]
(d)	ACE Improvements	**Any two** from		
		Larger quantity of starch – no effect **because** starch is the **indicator** or **wtte.**	1	
		Larger volume of KI – no effect **because** KI is already in **excess or** will have an effect **because** KI not (already) in **excess.**	1	
		Filter before titration – effective **because** easier to see **end-point**/ **colour change** or not effective **because** iodine/chemicals stay on the filter paper.		[2]
				[Total: 12]
2 (a)	MMO Collection	Mass of zinc used between 2.1 and 2.3 g. Subtraction must be correct from unambiguous weighings.	1	
	PDO Recording	Table **completed** and all temperatures recorded to 0.0 or 0.5°C. Must include at least one ending in 0.0 and one ending in 0.5.	1	[2]
(b) (i)	PDO Layout	Axes labelled temperature or T/°C or (°C) or temperature in °C (*y*-axis) and time (*x*-axis) or t/ minutes etc. Linear scales chosen so that graph occupies at least half the available length for both axes. This includes the 5 °C extension.	1	
(ii)	PDO Layout	Plotting accurate (within ½ small square and in correct square). Must plot all readings taken – minimum 10.	1	
	MMO Collection	2 straight lines drawn – one before 3 minutes and one after maximum temperature.	1	
	PDO Layout	3 appropriate lines drawn – including extrapolations (not falling).	1	[4]

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(c) (i)	ACE Interpretation	ΔT calculated. Examiner to check from graph and calculate to nearest 0.5°C. Candidate's answer must be correct to nearest 0.5°C, decimal places not needed for 0.0. Allow ΔT at 3½ min, even if not max, provided some indication on graph.	1	
(ii)	PDO Display	Correctly calculates 50 × 4.3 × candidate's ΔT (from **(i)** unless value from graph was not using maximum vertical). Must be max.	1	
(iii)	ACE Interpretation	Moles Zn = $\frac{\text{candidate's mass of zinc}}{65.4}$ (working must be shown and answer correct to significant figures shown)	1	
		Moles Cu^{2+} = $\frac{50 \times 1.1}{1000}$ = 0.055 (working must be shown and answer correct to significant figures shown)	1	
(iv)		$\frac{\textbf{(c)(ii)}}{1000 \times \text{moles of Zn (from } \textbf{(c)(iii)})}$ (correctly calculated, ecf possible)	1	
	ACE Conclusion	Sign negative and answer to 2–4 significant figures (stand alone).	1	[6]
(d)	ACE Interpretation	Error in one temperature reading = 0.5 (°C)	1	
		Maximum % error = $\frac{1.0 \times 100}{12.0}$ = 8.3(3) % (ecf 2 × error)	1	
		Expression or correct answer.		[2]
				[Total: 14]

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FB 5 is $NiSO_4(aq)$; **FB 6** is $K_2CrO_4(aq)$; **FB 7** is $H_2SO_4(aq)$; **FB 8** is $BaCl_2(aq)$				
3 (a) (i)	MMO Collection	Solution/ **FB 5**/liquid goes from green to blue.	1	
		Green precipitate **and** insoluble in excess.	1	
		Unqualified white precipitate, insoluble in acid.	1	
(ii)	ACE Conclusions	**FB 5** is a sulfate/nickel sulfate/$NiSO_4$/SO_4^{2-}. (allow conclusion even if green ppt in **(i)**)	1	[4]
(b) (i)	MMO Collection	Solution/**FB 6**/liquid goes from yellow to orange.	1	
		(Solution) goes green/blue (allow grey-green or blue-green).	1	
		Yellow precipitate.	1	
		Anion in **FB 6** is CrO_4^{2-}/ chromate	1	
		Cation in **FB 7** is H^+/ hydrogen	1	
(ii)	ACE Conclusions	Cation in **FB 8** is Ba^{2+}/ barium or Pb^{2+}/ lead.	1	
(iii)	MMO Decisions	Add named (aqueous) chloride – white ppt Pb^{2+} (not Ba^{2+}) or Add (aqueous) NaOH – white ppt Pb^{2+} (not Ba^{2+}) or Add (aqueous) ammonia - white ppt Pb^{2+} (not Ba^{2+}) or Add (aqueous) KI – yellow ppt Pb^{2+} (not Ba^{2+}) or Add (aqueous) named chromate (only allow if **FB 6** not identified as chromate) – yellow ppt both Ba^{2+} and Pb^{2+} with indication that Ba^{2+} is paler.	1	
		Allow ecf from candidate's **FB 8.**		[7]
(c)	ACE Conclusions	Prediction must follow identities of **FB 5** and **FB 8**. (If these correct then should be white ppt.) If candidate's ions in **(b)(ii)** and **(a)(ii)** would give two different results, both must be specified.	1	[1]
(d)	ACE Conclusions	(Ethanol/it was) oxidised/ an aldehyde was formed/ a carboxylic acid was formed (not redox).	1	[1]
(e)	MMO Decisions	Uses a (named) carbonate or a (named) reactive metal to produce effervescence/ positive test for the gas. Named indicator with correct colour. NaOH with temperature increase. (no ecf possible)	1	[1]
				[Total: 14]

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