CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2013 series

9701 CHEMISTRY

9701/35 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 October/November 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

Question	Sections	Indicative material	Mark	
1 (a)	PDO *Layout*	**I** Volume given for rough titre **and** accurate burette readings tabulated. (min of 2 × 2 box)	1	
	MMO *Collection*	**II** Initial and final burette readings recorded for rough titre **and** volume of **FA 2** added recorded for each accurate titre **and** acceptable headings and units in the accurate section. *Acceptable headings are initial (burette) reading/ initial volume/first reading/start reading* *Final (burette) reading/final volume/2nd reading/end reading* *Titre/volume used/volume added/**FA 2** added.(not difference or change in)* *Acceptable units are/cm^3/in cm^3/(cm^3)/cm^3 by each reading.*	1	
	PDO *Recording*	**III** **All** accurate burette readings recorded to nearest 0.05 cm^3. *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 2 titres within 0.1 cm^3, a further titration is carried out which is > 0.1 cm^3 from the closer of the 2 initial titres unless further titrations, within 0.1 of any others, have also been carried out.* *Do not award the mark if any accurate burette readings (apart from initial zero) are given as integer.*	1	

	MMO *Quality*	**V, VI and VII** All burette readings should be rounded to the nearest $0.05\,cm^3$. Subtractions should be checked. Examiner then selects the 'best' titre using the hierarchy: two identical, titres within $0.05\,cm^3$ etc. These best titres should be used to calculate the mean titre to the nearest $0.01\,cm^3$. Award **V, VI and VII** for a difference from Supervisor $\leq 0.2\,cm^3$. Award **V and VI** for a difference from Supervisor $0.2 < \delta \leq 0.3\,cm^3$. Award **V** for a difference from Supervisor $0.3 < \delta \leq$ to $0.5\,cm^3$. *Spread penalty: if the two 'best' titres used by the Examiner are ≥ 0.50 cm^3 apart, cancel 1 Q mark.*	3	[7]
(b)	ACE *Interpretation*	Candidate calculates the mean correctly. Candidate must take the average of two (or more) titres where the total spread is $\leq 0.2\,cm^3$. Working must be shown or ticks must be placed next to the accurate titres selected. The mean should normally be shown to **2 dp**, rounded to the nearest $0.01\,cm^3$. Example 26.667 must be rounded to 26.67 and not 26.65 and 26.675 must be rounded to 26.68 and not 26.70. Two special cases where the mean may not be to 2 dp: Allow mean to 3dp 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 – should be 26.05) *Do not award this mark if:* *The rough titre was used to calculate the mean.* *The candidate performed only one accurate titration.* *Burette readings were incorrectly subtracted to obtain any of the accurate titre values.* *All burette readings (resulting in titre values used in calculation of mean) are integers.* *Note: the candidate's mean will sometimes be marked 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 moles of NaOH = $\frac{\textbf{(b)} \times 0.1}{1000}$ in **(i)** **and** $\frac{\textbf{(i)} \times 1000}{25.0}$ in **(ii)**	1	
		II $1.85 \times 4 = 7.40$ (g dm^{-3}) **and** **(iii)** in **(iv)** **(ii)**	1	
	PDO *Display*	**III** All answers to 3 or 4 sf (minimum of 3 answers)	1	
	ACE *Conclusions*	**IV** Acid with nearest M_r. Conclusion must correspond to M_r.	1	
	MMO *Decisions*	**V** Test – (aqueous) bromine / **acidified** $KMnO_4$ / **alkaline** $KMnO_4$. Expected result – decolorises / (goes) colourless) / decolorised / turns green.	1	
				[5]
				[Total: 13]

Question	Sections	Indicative material	Mark	
2 (a)	PDO *Layout*	**I** Records at least four different balance readings (including 2 after heating) in the correct space.	1	
	PDO *Recording*	**II** Gives all appropriate headings and units for all weighings.	1	
		III All recorded **balance** readings consistent to at least 1 decimal place.	1	
	MMO *Quality*	**IV** Evidence of reheating to constant mass. For balances reading to 1 dp two masses must be identical. For 2 or 3 dp balances, two masses must be within 0.05 g.	1	
		V and VI Examiner calculates $\frac{\text{mass residue}}{\text{mass of water}}$ to 3 significant figures. Award **V** and **VI** for a difference from Supervisor up to 0.10. Award **V** for a difference $0.10 < \delta \leq 0.30$.	2	[6]
(b) (i)	ACE *Interpretation*	**I** Calculation of mass of water and iron(II) sulfate	1	
		II M_rs of 18 and 151.9 / sum of A_rs if correctly used	1	
(ii)	PDO *Display*	**III** Calculation $x = \frac{\text{mass water} \times 151.9}{\text{mass } FeSO_4 \times 18}$ (or 8.439 / ratio used for Q) **and**		
	ACE *Interpretation*	final answer to nearest integer.	1	[3]

(c)	ACE *Interpretation*	Spitting / decomposition of anhydrous salt / stirring	1	
	ACE *Improvements*	If value of x is too high, the final mass of solid must be too low/ some solid sticks to stirrer / crucible was wet and this water lost on heating / any statement that says that too much water is lost (free standing mark)	1	
		Spitting – lid / larger container / heat **more** gently.	1	
		Decomposition – practical suggestion to control temperature.		
		No improvement possible for stirring losses (max 2)		[3]
				[Total: 12]
FA 5 = $Pb(NO_3)_2$; **FA 6** = $CaCl_2$; **FA 7** is $Al(NO_3)_3$; **FA 8** is $ZnSO_4$				
3 (a) (i)	MMO *Collection*	Sublimes / OWTTE / white smoke / white gas	1	
		Litmus paper to blue **and** ammonia evolved.	1	
(ii)	MMO *Collection*	Fizzing / bubbles / **gas** turns limewater milky	1	
(iii)	MMO *Collection*	Sodium hydroxide – no reaction. Silver nitrate – white precipitate **and** dissolves partly in nitric acid / does not dissolve in nitric acid / bubbles	1 1	
(iv)	ACE *Conclusions*	Anions – CO_3^{2-} and Cl^-	1	
		Cation – NH_4^+	1	
(v)	MMO *Decisions*	(Aqueous) sodium hydroxide gives ammonia on heating	1	
(vi)	MMO *Collection*	White (precipitate) **and** barium carbonate. (ecf of barium sulfite if sulfite in **(iv)**)	1	[9]

(b) MMO *Collection*

test	*observations*			
	FA 5	**FA 6**	**FA 7**	**FA 8**
sodium hydroxide	white ppt	white ppt	white ppt	white ppt
excess	ppt dissolves	ppt remains	ppt dissolves	ppt dissolves
ammonia	white ppt	no reaction	white ppt	white ppt
excess	ppt remains		ppt remains	ppt dissolves
KI	yellow ppt	no reaction	no reaction	no reaction

(i) 1 mark for each correct vertical column
or
1 mark for each horizontal row (max 3 marks) 4

(ii) ACE *Conclusions*

FA 5 is Pb^{2+}, **FA 6** is Ca^{2+}, **FA 7** is Al^{3+}, **FA 8** is Zn^{2+}.
All correct scores 2 marks, 2 correct scores 1 mark. 2 [6]

[Total: 15]