CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the October/November 2015 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 October/November 2015 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

CAMBRIDGE
International Examinations

Question	Indicative material	Mark	Total
1 (a)	**I** The following readings are recorded • mass of Mg used • two burette readings and the titre for the rough titration • initial **and** final burette readings for **two** (or more) accurate titrations	1	
	II Titre values recorded for accurate titrations and appropriate headings for the accurate titration table **and** cm^3 units. • initial / start (burette) reading / volume • final / end (burette) reading / volume • titre **or** volume / **FB 2 and** used / added *(not "difference"or "total")* • unit: / cm^3 ***or*** (cm^3) ***or*** in cm^3 (for each heading) *If cm^3 units are not given in the headings, every entry in the table must have the correct unit.*	1	
	III All accurate burette readings are to the 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)* • *there is only one accurate titration.*	1	
	IV There are two uncorrected **accurate** titres within 0.10 cm^3 • *Do **not** award this mark if, having performed two titres within 0.10 cm^3, a further titration is performed which is more than 0.10 cm^3 from the closer of the initial two titres, **unless** a further titration, within 0.10 cm^3 of any other, has also been carried out.* • *Do **not** award the mark if any "accurate" burette readings (apart from initial 0 cm^3) are given to **zero** dp*	1	
	Examiner checks and corrects titre subtractions where necessary. Examiner selects the best titres using the hierarchy: • two (or more) accurate identical titres *then* • two (or more) accurate titres within 0.05 cm^3, *then* two (or more) accurate titres within 0.10 cm^3, *etc.*These best titres are used to calculate the mean titre, expressed to nearest 0.01 cm^3. Examiner calculates the difference (δ) between the mean titres obtained by the candidate and the Supervisor. Accuracy marks are awarded as shown.		

Question	Indicative material	Mark	Total
	Award **V**, **VI** and **VII** if $\delta \leqslant$ **0.50** cm^3 Award **V** and **VI** if **0.50 <** $\delta \leqslant$ **1.00** cm^3 Award **V**, only, if **1.00 <** $\delta \leqslant$ **1.50** cm^3 **Spread penalty**: if the two "best" (corrected) titres used by the Examiner were $\geqslant 0.50\,cm^3$ apart, cancel **one** accuracy mark.	3	[7]
(b)	Candidate must take the average of two (or more) titres that are within a total spread of not more than $0.20\,cm^3$. Working / explanation 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 nearest $0.01\,cm^3$. *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 correct even if it was different from the mean calculated by the Examiner for the purpose of assessing accuracy.*	1	[1]
(c) (i)	mol NaOH = $0.120 \times {}^{25.0}/_{1000} = 0.003(00)$	1	
(ii)	• $NaOH + HCl \rightarrow NaCl + H_2O$ • Answer to **(ii)** must be the same as in **(i)**	1	
(iii) + (iv)	Correct **expressions** required in both **(iii)** and **(iv)** (*Correct expression = correct figures shown*) **(iii) :** no moles of HCl (in $250\,cm^3$) = **(ii)** $\times {}^{250}/_{\textbf{(b)}}$ **(iv) :** no moles of HCl (in $25.0\,cm^3$) = $2.00 \times {}^{25.0}/_{1000}$ (= 0.05)	1	
(v)	Correct expression: Mol HCl used = **(iv) – (iii)**	1	
(vi)	Equation **and** correctly calculates answer for number of moles Mg: • $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$ • No of moles Mg = $0.5 \times$ **(v)**	1	
(vii)	$A_r = {}^{\text{mass of Mg used}}/_{\textbf{(vi)}}$	1	[6]
(d) (i)	All solid / magnesium dissolved / disappeared / reacted (owtte) **or** indicator turned from blue to yellow when **FB 2** added (to alkali)	1	
(ii)	(If 1.0 g Mg is used) Mg would be in excess / acid would be the limiting reagent / all the acid would be used up	1	

Question	Indicative material	Mark	Total
	Reference to moles of both acid and Mg (or other correct calculation) Calculation to show that Mg would be in excess n(Mg) = $^{1}/_{24.3}$ = 0.041 mol (allow $^{1}/_{24}$ or $^{1}/_{\text{(c)(vii)}}$) n(HC*l*) needed = 0.082 mol or only 0.05 mol present	1	
Qn 1		**Total**	**[17]**

Question	Indicative material	Mark	Total
2 (a)	**I** Table / list of data, showing the following: • five unambiguous / clear headings *accept 'mass of ...' or '... / g' (**not** 'weight')* *accept "mass of crucible + **FB 4** after heating"* *ignore omission of the crucible lid* • three balance readings, with unit shown at least once • mass of water (***or*** mass lost) • mass of residue *(owtte)* • all calculations must be correct *All data must be written in the space provided*	1	
	Examiner should check calculations of masses of water and anhydrous $MgSO_4$. Examiner calculates the ratio $^{\text{mass of water lost}}/_{\text{mass of residue}}$ to 2 dp The theoretical value is 1.0465...Marks awarded for accuracy as shown.		
	Award **II** if the ratio is between 0.80 and 1.15 (inclusive) Award **III** if the ratio is between 0.95 and 1.10	2	[3]
(b) (i)	Correctly calculates to 2 – 4 sf Number of moles = $^{\text{mass loss}}/_{18}$	1	
(ii)	Correctly calculates to 2 – 4 sf Number of moles of anhydrous $MgSO_4$ = $^{\textbf{(i)}}/_{7}$	1	
(iii)	Working / expression for M_r and answer of the correct magnitude given to 2 – 4 sf M_r = $^{\text{mass of residue}}/_{\textbf{(ii)}}$	1	
(iv)	Correctly calculates relative atomic mass: A_r = **(iii)** – 96.1	1	[4]
(c) (i)	Reheat solid / residue to **constant mass**.	1	
(ii)	To prevent absorption of water (vapour)	1	[2]
Qn 2		**Total**	**[9]**

Question	Indicative material	Mark	Total
	FB 5 is $MgCl_2(aq)$; **FB 6** is $Zn(NO_3)_2(s)$		
3 (a)	Two reagents needed • sodium hydroxide • barium chloride / barium nitrate Observations: • NaOH – white precipitate, insoluble in excess • Barium ions – no precipitate / no change / no reaction Conclusions: • Mg^{2+} / magnesium (ion) is present **and** • SO_4^{2-} / sulfate (ion) is **not** present	1 1 1 1	[4]
(b) (i)	Heating **FB 6**: look for the following **nine** observations • (on gentle heating) solid melts / dissolves / turns to liquid / solution • liquid is colourless • bubbling / fizzing / effervescence / boiling • steam / (water) vapour given off / misty fumes / condensation formed • (when strongly heated), brown gas / fumes • yellow solid / residue formed • (gas) relights a glowing splint • gas turns (blue) litmus red (ignore bleaching) • white / cream / paler (yellow) solid / residue *Award marks as shown.* • *5 observations correct = 4 marks* • *4 observations correct = 3 marks* • *3 observations correct = 2 marks* • *2 observations correct = 1 mark*	4	

Question	Indicative material	Mark	Total
(ii)	Observations with $AgNO_3$ and H_2SO_4 No reaction / no change in **both**	1	
	With NH_3 – white precipitate soluble in excess	1	
	With **cold** NaOH – white precipitate soluble in excess	1	
	With **hot** NaOH – no reaction / no gas produced / (gas) did **not** turn red litmus blue	1	
	With NaOH + A*l* (gas) turns (damp red) litmus blue	1	
(iii)	Identification – **FB 6** is $Zn(NO_3)_2$	1	[10]
Qn 3		**Total**	**[14]**