

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.

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – October/November 2015	9701	34

Question	Indicative material	Mark	Total
1 (a)	<p>I The following readings are recorded</p> <ul style="list-style-type: none"> • 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	
	<p>II Titre values recorded for accurate titrations and appropriate headings for the accurate titration table and cm³ units.</p> <ul style="list-style-type: none"> • initial/ start (burette) reading/ volume • final/ end (burette) reading/ volume • titre or volume/ FB 2 and used/ added (<i>not</i> “difference” or “total”) • unit: / cm³ or (cm³) or in cm³ (for each heading) <i>If cm³ units are not given in the headings, every entry in the table must have the correct unit.</i> 	1	
	<p>III All accurate burette readings are to the nearest 0.05 cm³. Do not award this mark if:</p> <ul style="list-style-type: none"> • 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	
	<p>IV There are two uncorrected accurate titres within 0.10 cm³</p> <ul style="list-style-type: none"> • Do not award this mark if, having performed two titres within 0.10 cm³, a further titration is performed which is more than 0.10 cm³ from the closer of the initial two titres, unless a further titration, within 0.10 cm³ of any other, has also been carried out. • Do not award the mark if any “accurate” burette readings (apart from initial 0 cm³) are given to zero dp 	1	
	<p>Examiner checks and corrects titre subtractions where necessary. Examiner selects the best titres using the hierarchy:</p> <ul style="list-style-type: none"> • two (or more) accurate identical titres <i>then</i> • two (or more) accurate titres within 0.05 cm³, <i>then</i> <p>two (or more) accurate titres within 0.10 cm³, <i>etc.</i> These best titres are used to calculate the mean titre, expressed to nearest 0.01 cm³. Examiner calculates the difference (δ) between the mean titres obtained by the candidate and the Supervisor. Accuracy marks are awarded as shown.</p>		

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Question	Indicative material	Mark	Total
	<p>Award V, VI and VII if $\delta \leq 0.50 \text{ cm}^3$ Award V and VI if $0.50 < \delta \leq 1.00 \text{ cm}^3$ Award V, only, if $1.00 < \delta \leq 1.50 \text{ cm}^3$ Spread penalty: if the two “best” (corrected) titres used by the Examiner were $\geq 0.50 \text{ cm}^3$ apart, cancel one accuracy mark.</p>	3	[7]
(b)	<p>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.</p> <p><i>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.</i></p> <p>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.</p>	1	[1]
(c) (i)	mol NaOH = $0.120 \times \frac{25.0}{1000} = 0.003(00)$	1	
(ii)	<ul style="list-style-type: none"> NaOH + HCl \rightarrow NaCl + H₂O Answer to (ii) must be the same as in (i) 	1	
(iii) + (iv)	<p>Correct expressions required in both (iii) and (iv) <i>(Correct expression = correct figures shown)</i> (iii) : no moles of HCl (in 250 cm^3) = (ii) $\times \frac{250}{(b)}$ (iv) : no moles of HCl (in 25.0 cm^3) = $2.00 \times \frac{25.0}{1000}$ (= 0.05)</p>	1	
(v)	Correct expression: Mol HCl used = (iv) – (iii)	1	
(vi)	<p>Equation and correctly calculates answer for number of moles Mg:</p> <ul style="list-style-type: none"> $\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$ No of moles Mg = $0.5 \times \text{(v)}$ 	1	
(vii)	$A_r = \frac{\text{mass of Mg used}}{\text{(vi)}}$	1	[6]
(d) (i)	<p><u>All</u> solid / magnesium dissolved / disappeared / reacted (owtte) or indicator turned from blue to yellow when FB 2 added (to alkali)</p>	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	

Page 4	Mark Scheme	Syllabus	Paper
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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 $n(\text{Mg}) = \frac{1}{24.3} = 0.041 \text{ mol}$ (allow $\frac{1}{24}$ or $\frac{1}{(c)(vii)}$) $n(\text{HCl})$ needed = 0.082 mol or only 0.05 mol present	1	
Qn 1		Total	[17]

Page 5	Mark Scheme	Syllabus	Paper
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Question	Indicative material	Mark	Total
2 (a)	<p>I Table /list of data, showing the following:</p> <ul style="list-style-type: none"> • five unambiguous / clear headings <i>accept 'mass of ...' or '... / g' (not 'weight')</i> <i>accept "mass of crucible + FB 4 after heating"</i> <i>ignore omission of the crucible lid</i> • three balance readings, with unit shown at least once • mass of water (or mass lost) • mass of residue (<i>owtte</i>) • all calculations must be correct <p><i>All data must be written in the space provided</i></p>	1	
	<p>Examiner should check calculations of masses of water and anhydrous MgSO_4. Examiner calculates the ratio $\frac{\text{mass of water lost}}{\text{mass of residue}}$ to 2 dp The theoretical value is 1.0465...Marks awarded for accuracy as shown.</p>		
	<p>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</p>	2	[3]
(b) (i)	<p>Correctly calculates to 2 – 4 sf Number of moles = $\frac{\text{mass loss}}{18}$</p>	1	
(ii)	<p>Correctly calculates to 2 – 4 sf Number of moles of anhydrous $\text{MgSO}_4 = \frac{(\text{i})}{7}$</p>	1	
(iii)	<p>Working / expression for M_r and answer of the correct magnitude given to 2 – 4 sf $M_r = \frac{\text{mass of residue}}{(\text{ii})}$</p>	1	
(iv)	<p>Correctly calculates relative atomic mass: $A_r = (\text{iii}) - 96.1$</p>	1	[4]
(c) (i)	Reheat solid / residue to constant mass .	1	
(ii)	To prevent absorption of water (vapour)	1	[2]
Qn 2		Total	[9]

Page 6	Mark Scheme	Syllabus	Paper
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Question	Indicative material	Mark	Total
FB 5 is $\text{MgCl}_2(\text{aq})$; FB 6 is $\text{Zn}(\text{NO}_3)_2(\text{s})$			
3 (a)	Two reagents needed	1	[4]
	<ul style="list-style-type: none"> sodium hydroxide barium chloride / barium nitrate 		
	Observations:		
	<ul style="list-style-type: none"> NaOH – white precipitate, insoluble in excess Barium ions – no precipitate / no change / no reaction 	1 1	
(b) (i)	Conclusions:		
	<ul style="list-style-type: none"> Mg^{2+} / magnesium (ion) is present and SO_4^{2-} / sulfate (ion) is not present 	1	
(b) (i)	Heating FB 6 : look for the following nine observations	4	
	<ul style="list-style-type: none"> (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 		
(b) (i)	<i>Award marks as shown.</i>	4	
	<ul style="list-style-type: none"> 5 observations correct = 4 marks 4 observations correct = 3 marks 3 observations correct = 2 marks 2 observations correct = 1 mark 		

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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 $\text{NaOH} + \text{Al}$ (gas) turns (damp red) litmus blue	1	
(iii)	Identification – FB 6 is $\text{Zn}(\text{NO}_3)_2$	1	[10]
Qn 3	Total		[14]