

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Level

MARK SCHEME for the October/November 2014 series

9701 CHEMISTRY

9701/51

Paper 5 (Planning, Analysis and Evaluation),
maximum raw mark 30

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 2014 series for most Cambridge IGCSE[®], Cambridge International A and AS Level components and some Cambridge O Level components.

® IGCSE is the registered trademark of Cambridge International Examinations.

Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – October/November 2014	9701	51

Question	Expected Answer			Mark	
1 (a)	reagent added	reagent added	reagent added		
	sulfuric acid	(excess, aqueous) ammonia	sulfuric acid		
	substances present at the end of the reaction	substances present at the end of the reaction	substances present at the end of the reaction		
	zinc sulfate AND aluminium sulfate(copper)	zinc (tetra) ammine (ions) (aluminium hydroxide)	ammonium sulfate (zinc hydroxide)		
	substances removed by filtration	substances removed by filtration	substances removed by filtration		
	copper	aluminium hydroxide	zinc hydroxide		
	Allow: Correct formulae or ions instead of names.				
(b)	Step 1: Sufficient/enough/excess sulfuric acid (to dissolve the zinc and aluminium)			1	
	Step 2: Sufficient/enough/excess aqueous ammonia (to precipitate aluminium hydroxide and to completely dissolve the zinc hydroxide)			1	
	Step 3: Sufficient/enough/sulfuric acid to:			1	
	neutralise/react with ammonia (re-) precipitate the zinc hydroxide but not so much that the zinc hydroxide reacts/dissolves			1	
				[4]	
(c)	Heat (the hydroxides)			1	
	To constant mass			1	
					[2]

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – October/November 2014	9701	51

Question	Expected Answer	Mark	
(d)	Measure mass of any three of solder, copper, zinc oxide/hydroxide and aluminium oxide/hydroxide or residues/precipitates	1	
	The copper should be washed (with water/propanone or any other suitable organic solvent) and dried	1	[2]
(e)	0.794 g	1	[1]
(f)	The mass/amount/percentage of copper is small	1	[1]
Total			15

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – October/November 2014	9701	51

Question	Expected Answer	Mark	
2 (a)	All plotted points correctly drawn	1	[2]
	The best fit line should pass through or lie close to the first 10 points. (If all points do not lie on the line then the net deviation of the non-anomalous points on each side of the best fit line must be approximately the same.)	1	
(b)	The point at 12.00 cm ³ is an anomaly. (ECF from incorrect anomalous point.)	1	[2]
	The sodium hydroxide has not been properly mixed with the acid OR insufficient sodium hydroxide was added.	1	
(c)	Indicator range between 6.5 and 11 for a minimum of 1 pH unit change.	1	[1]
(d) (i)	Any two of the following: Na ⁺ , A ⁻ , HA	1	[1]
(ii)	They will all have (nearly) the same concentration OR A ⁻ > Na ⁺ > HA	1	[2]
	Half of the HA has reacted with/been neutralised by /used up by the NaOH	1	
(e)	Reads correct value of pH from the graph drawn	1	[3]
	Gives correct expression for K _a	1	
	Calculates K _a .	1	
(f) (i)	[H ⁺] = 0.00389 mol dm ⁻³ OR [H ⁺] = [A ⁻] ECF as (ans to [H ⁺]) ² /(ans to (e))	1	[2]
	Calculates [HA] correctly based on the pH read from the graph	1	

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – October/November 2014	9701	51

Question	Expected Answer	Mark	
(ii)	Conc of HA = $4 \times 2.7 = 10.8 \text{ g dm}^{-3}$ Relative molecular mass of HA = 10.8/ 2(f)(i)	1	[1]
(g)	Any appropriate error discussion e.g.: • many readings / measurements are taken each of which will have an error., • the H^+ from the water has been ignored, • no pH reading was taken at 15.00 cm^3, • H^+ is not exactly equal to A^- temperature varies during titration, • graph drawn by hand is not very accurate, • experiment not repeated.	1	[1]
Total			15

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Level

MARK SCHEME for the October/November 2014 series

9701 CHEMISTRY

9701/52

Paper 5 (Planning, Analysis and Evaluation),
maximum raw mark 30

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 2014 series for most Cambridge IGCSE[®], Cambridge International A and AS Level components and some Cambridge O Level components.

® IGCSE is the registered trademark of Cambridge International Examinations.

Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – October/November 2014	9701	52

Question	Expected Answer			Mark	
1 (a)	reagent added	reagent added	reagent added		
	sulfuric acid	(excess, aqueous) ammonia	sulfuric acid		
	substances present at the end of the reaction	substances present at the end of the reaction	substances present at the end of the reaction		
	zinc sulfate AND aluminium sulfate(copper)	zinc (tetra) ammine (ions) (aluminium hydroxide)	ammonium sulfate (zinc hydroxide)		
	substances removed by filtration	substances removed by filtration	substances removed by filtration		
	copper	aluminium hydroxide	zinc hydroxide		
	Allow: Correct formulae or ions instead of names.				
(b)	Step 1: Sufficient/enough/excess sulfuric acid (to dissolve the zinc and aluminium)			1	
	Step 2: Sufficient/enough/excess aqueous ammonia (to precipitate aluminium hydroxide and to completely dissolve the zinc hydroxide)			1	
	Step 3: Sufficient/enough/sulfuric acid to:			1	
	neutralise/react with ammonia (re-) precipitate the zinc hydroxide but not so much that the zinc hydroxide reacts/dissolves			1	
				[4]	
(c)	Heat (the hydroxides)			1	
	To constant mass			1	
					[2]

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – October/November 2014	9701	52

Question	Expected Answer	Mark	
(d)	Measure mass of any three of solder, copper, zinc oxide/hydroxide and aluminium oxide/hydroxide or residues/precipitates	1	
	The copper should be washed (with water/propanone or any other suitable organic solvent) and dried	1	[2]
(e)	0.794 g	1	[1]
(f)	The mass/amount/percentage of copper is small	1	[1]
Total			15

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – October/November 2014	9701	52

Question	Expected Answer	Mark	
2 (a)	All plotted points correctly drawn	1	[2]
	The best fit line should pass through or lie close to the first 10 points. (If all points do not lie on the line then the net deviation of the non-anomalous points on each side of the best fit line must be approximately the same.)	1	
(b)	The point at 12.00 cm ³ is an anomaly. (ECF from incorrect anomalous point.)	1	[2]
	The sodium hydroxide has not been properly mixed with the acid OR insufficient sodium hydroxide was added.	1	
(c)	Indicator range between 6.5 and 11 for a minimum of 1 pH unit change.	1	[1]
(d) (i)	Any two of the following: Na ⁺ , A ⁻ , HA	1	[1]
(ii)	They will all have (nearly) the same concentration OR A ⁻ > Na ⁺ > HA	1	[2]
	Half of the HA has reacted with/been neutralised by /used up by the NaOH	1	
(e)	Reads correct value of pH from the graph drawn	1	[3]
	Gives correct expression for K _a	1	
	Calculates K _a .	1	
(f) (i)	[H ⁺] = 0.00389 mol dm ⁻³ OR [H ⁺] = [A ⁻] ECF as (ans to [H ⁺]) ² /(ans to (e))	1	[2]
	Calculates [HA] correctly based on the pH read from the graph	1	

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – October/November 2014	9701	52

Question	Expected Answer	Mark	
(ii)	Conc of HA = $4 \times 2.7 = 10.8 \text{ g dm}^{-3}$ Relative molecular mass of HA = 10.8/ 2(f)(i)	1	[1]
(g)	Any appropriate error discussion e.g.: • many readings / measurements are taken each of which will have an error., • the H^+ from the water has been ignored, • no pH reading was taken at 15.00 cm^3, • H^+ is not exactly equal to A^- temperature varies during titration, • graph drawn by hand is not very accurate, • experiment not repeated.	1	[1]
Total			15

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Level

MARK SCHEME for the October/November 2014 series

9701 CHEMISTRY

9701/53

Paper 5 (Planning, Analysis and Evaluation),
maximum raw mark 30

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 2014 series for most Cambridge IGCSE[®], Cambridge International A and AS Level components and some Cambridge O Level components.

® IGCSE is the registered trademark of Cambridge International Examinations.

Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – October/November 2014	9701	53

Question	Expected Answer	Additional Guidance	Mark	
1 (a)	(i) $\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2$		1	
	(ii) $2\text{Al} + 3\text{H}_2\text{SO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{H}_2$		1	[2]
(b)	(i) The mass of magnesium		1	[1]
	(ii) The temperature change		1	[1]
(c)	(i) 12.35cm^3 ECF equation in (a)		1	[1]
	(ii) The sulfuric acid must be in excess OR to ensure all the Mg has reacted / disappeared / dissolved / is the limiting reagent		1	[1]
(d)	mol of Al = 0.011 (mol) AND mol of sulfuric acid = 0.0167 (mol)		1	
	Volume of sulfuric acid = 16.67cm^3		1	[2]
(e) (i)	The volume / mass of sulfuric acid / solution OR a stated volume of sulfuric acid. AND The initial / start temperature (of the acid) AND The final / end temperature (reached by the acid)		1	[1]
(ii)	Insulate (the reaction mixture) OR Stir (the mixture while the reaction is taking place)		1	[1]

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – October/November 2014	9701	53

Question	Expected Answer	Additional Guidance	Mark	
2 (a) (i)	$\text{Ni}^{2+}(\text{aq}) + 2\text{IO}_3^{-}(\text{aq}) \rightarrow \text{Ni}(\text{IO}_3)_2(\text{s})$		1	[1]
(ii)	0.1000		1	[1]
(iii)	More precipitate will form		1	[1]
(b) (i)	All points plotted correctly Straight line drawn through the origin up to at least exp 7. (If all points do not lie on the line then the net deviation of the non-anomalous points on each side of the best fit line must be approximately the same.)		1 1	[2]
(ii)	Points at 0.0300 mol and 0.0500 mol		1	[1]
(iii)	Loss of precipitate during transfer to filter OR Precipitate not dry OR Not weighing to constant mass OR Precipitate contains ionic materials not removed		1	[1]
(iv)	Point at 0.1000 lies on the extrapolated drawn line of best fit. Point at 0.1200 either at the same value as 0.1000 or slightly higher value		1 1	[2]
(c) (i)	8.174 g		1	[1]

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – October/November 2014	9701	53

Question	Expected Answer	Additional Guidance	Mark	
(ii)	0.254 g (from c(i) – 7.92)		1	
	0.000621 (mol)		1	
	$\text{IO}_3^- = 0.00124$ (mol)		1	[3]
(iii)	$[\text{Ni}^{2+}] = 0.306$ AND $[\text{IO}_3^-] = 0.0124$ ECF		1	
	4.71×10^{-5}		1	[2]