

MARK SCHEME for the October/November 2012 series

9701 CHEMISTRY

9701/31

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 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

Page 2	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	31

Question	Sections	Indicative material		Mark	Total
1 (a)	PDO Recording	I	All columns correctly headed and correct units given for all columns except for rate/(1000/time) e.g. /s, (s), time in s, time in seconds.	1	
		II	Records all times to the nearest second. Allow for only 5 expts carried out.	1	
	MMO Decisions	III	Additional experiment (experiment 6) uses volume of FA 1 $\geq 3 \text{ cm}^3$ of any other, and adds water to make 50 cm^3 . Other volumes are those specified.	1	
	PDO Display	IV	Candidate gives all values of (1000/time) to 3 sig fig – ignore calculation or rounding errors (minimum of 4 expts carried out).	1	
	ACE Interpretation	V	All values of (1000/time) correctly calculated to sig fig shown by candidate (minimum of 4 expts carried out).	1	
	MMO Quality	VI and VII	Experiments 2 and 4: calculate $100(2t_2 - t_4)/t_4 \leq 20\%$ for 1 mark; $\leq 10\%$ for 2 marks.	6	
		VIII and IX	Experiments 3 and 5: calculate $100(3t_3 - t_5)/t_5 \leq 30\%$ for 1 mark; $\leq 10\%$ for 2 marks.		
		X and XI	Experiments 4 and 5: calculate $100(2t_4 - t_5)/t_5 \leq 30\%$ for 1 mark; $\leq 10\%$ for 2 marks.		
		If the candidate has not completed the 5 th experiment, marks VI and VII are available. Also check Experiments 1 and 2: t_2 should equal to $t_1 \times 5/4$. Use the 10% and 20% boundaries.			
		If only the first three experiments are completed, award Q marks based on Experiments 1 and 2 (as above). (If 50, 45, 40, 35, marks X and XI not available. Use 40 and 20 if there + ‘rescue’ pair as above.) The Examiner is to round all reaction times to the nearest second before awarding accuracy marks. (Volumes FA 1 /expt no as specified in Qn)			

[11]

Page 3	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	31

(b)	PDO Layout	I Plots rate or (1000/time) on y-axis and volume of FA 1/FA 1 cm ³ on x-axis. Axes correctly labelled.	1	[5]
		II Uniform scales selected. Each scale starts at zero and highest point plotted on each axis has used more than half of the available grid.	1	
		III and Examiner to check all plotted points. IV Points must be correct to ½ small square and in correct small square.	2	
		Award III and IV for correct points for all experiments carried out (minimum 5). Award III only if one mistake made. (If only four expts carried out then all 4 correct.) V Draws a “best-fit” straight line – one that passes close to the majority of points and points are balanced. The line does not have to pass through the origin. (Allow curve if appropriate.)	1	
(c)	ACE Conclusions	Depth (of solution) is greater, ... so time is shorter/less// <u>time</u> is faster//fewer seconds (<i>time is conditional on depth</i>)	1	[2]
		or solution/liquid depth unchanged so reaction time unchanged for 1 mark.	1	
(d)	ACE Interpretation	Give one mark for a concentration of 0.021/0.0214/0.02143 mol dm ⁻³ for expt 5.	1	[2]
	PDO Display	Working shown must include correct use of 70.	1	

Page 4	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	31

(e)	ACE Interpretation	Two pieces of evidence with no conclusion or one piece and conclusion. 2 nd piece of evidence and conclusion.	1	
		Evidence for ‘correct’ (i) a straight line/(line with) constant gradient (ii) straight line passes through origin (if appropriate from results) is 2 pieces of evidence (iii) line passes through origin = 1 if line drawn is straight Evidence for ‘incorrect’ (i) a curve has been drawn/no straight line/not constant gradient (ii) straight line does not pass through the origin (iii) points too scattered/not on best fit line (iv) a curve drawn but expect straight line = 2 <i>A straight line, not passing through the origin could score both marks depending on explanation given (proportional but not directly proportional). If two points are compared they must be on or very close to the graph line.</i>	1	
(f)	ACE Interpretation	Candidate correctly evaluates each % uncertainty.	1	[1]
(g)	ACE Improvement/s	Constant volume of FA 1 .	1	[2]
		Varies volume of FA 2 and water correspondingly (Volume FA 2 + H ₂ O same).	1	
Total			25	

Page 5	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	31

FA 3 is $\text{CuCl}_2(\text{aq})$; **FA 4** is $\text{AlK}(\text{SO}_4)_2(\text{aq}) + \text{KI}(\text{aq})$; **FA 5** is $\text{FeCl}_3(\text{aq})$; **FA 6** is $\text{Pb}(\text{NO}_3)_2(\text{aq})$

2	(a)	MMO Collection	Records a blue / greenish-blue ppt / solid with FA 3 and Na_2CO_3 .	1	[4]
			Records a brown / rust / orange-brown / red-brown ppt / solid with FA 5 and Na_2CO_3 .	1	
			Records effervescence with FA 5 (or FA 3).	1	
		MMO Decisions	Tests <u>gas</u> evolved with limewater. Allow from effervescence.	1	
	(b)	MMO Collection	Records a white precipitate with silver nitrate solution and soluble in aqueous ammonia.	1	[1]
	(c)	MMO Collection	Records yellow-brown / orange-brown / brown / tan colour (solid/solution) (formed on mixing FA 4 and FA 3). Allow dark brown for solution only . Allow (qualified) brown solution with white / off-white / grey ppt. Dark / deep blue / blue-black / black / purple colour on adding starch solution	1 1	[2]
	(d)	MMO Collection	Mark the observations in the table horizontally or vertically to maximise marks available to the candidate.	4	[4]

Test	Observations			
	FA 3	FA 4	FA 5	FA 6
$\text{NaOH}(\text{aq})$	blue ppt not dark/deep blue ppt	white ppt (which dissolves as more added/then dissolves)	red-brown / orange-brown / brown / rust ppt (not dark / deep brown)	white ppt
excess NaOH	ppt insoluble (no change no observation provided ppt above)	ppt soluble (if no ppt in 1 st box allow no change)	ppt insoluble (no change no observation provided ppt above)	ppt soluble (not no change after 'no ppt')
$\text{NH}_3(\text{aq})$	blue ppt not dark/deep blue ppt	white ppt	red-brown / orange-brown / brown / rust ppt (not dark / deep brown)	white ppt
excess ammonia	(ppt soluble) deep blue soln	ppt insoluble (no change no observation provided ppt above)	ppt insoluble (no change no observation provided ppt above)	ppt insoluble (no change no observation provided ppt above)

Page 6	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	31

FA 3 is $\text{CuCl}_2(\text{aq})$; FA 4 is $\text{AlK}(\text{SO}_4)_2(\text{aq}) + \text{KI}(\text{aq})$; FA 5 is $\text{FeCl}_3(\text{aq})$; FA 6 is $\text{Pb}(\text{NO}_3)_2(\text{aq})$					
(e)	ACE Conclusions	Con2	Give one mark for FA 3 Cu^{2+} /copper/copper(II) and FA 5 Fe^{3+} /iron(III).	1	[2]
		Con2	Give one mark for FA 4 and FA 6 Al^{3+} /aluminium, Pb^{2+} /lead Allow FA 4 $\text{Al}^{3+}(\text{Pb}^{2+})$ and FA 6 Al^{3+} , Pb^{2+} (There must be some correct evidence for Cu^{2+} and Fe^{3+} in (d) but does not have to be fully correct.)	1	
(f)	MMO Decisions	De7	Selects appropriate reagent to distinguish between Al^{3+} and Pb^{2+} e.g. KI, K_2CrO_4 , H_2SO_4 , HCl (not BaCl_2).	1	[1]
(g)	ACE Conclusions	Con2	No error carried forward in this section. Award the mark for: FA 3 chloride FA 4 iodide FA 5 insufficient tests	1	[1]
Total				15	

MARK SCHEME for the October/November 2012 series

9701 CHEMISTRY

9701/33

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 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

Page 2	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	33

Question	Sections	Indicative material	Mark	Total
1 (a)	PDO Recording	I All columns correctly headed and correct units given for all columns except for rate/(1000/time) e.g. /s, (s), time in s, time in seconds.	1	
		II Records all times to the nearest second. Allow for only 5 expts carried out.	1	
	MMO Decisions	III Additional experiment (experiment 6) uses volume of FA 1 $\geq 3 \text{ cm}^3$ of any other, and adds water to make 50 cm^3 . Other volumes are those specified.	1	
	PDO Display	IV Candidate gives all values of (1000/time) to 3 sig fig – ignore calculation or rounding errors (minimum of 4 expts carried out).	1	
	ACE Interpretation	V All values of (1000/time) correctly calculated to sig fig shown by candidate (minimum of 4 expts carried out).	1	
	MMO Quality	VI and Experiments 2 and 4: VII calculate $100(2t_2 - t_4)/t_4 \leq 20\%$ for 1 mark; $\leq 10\%$ for 2 marks.	6	
		VIII and Experiments 3 and 5: IX calculate $100(3t_3 - t_5)/t_5 \leq 30\%$ for 1 mark; $\leq 10\%$ for 2 marks.		
		X and Experiments 4 and 5: XI calculate $100(2t_4 - t_5)/t_5 \leq 30\%$ for 1 mark; $\leq 10\%$ for 2 marks.		
		If the candidate has not completed the 5 th experiment, marks VI and VII are available. Also check Experiments 1 and 2: t_2 should equal to $t_1 \times 5/4$. Use the 10% and 20% boundaries.		
		If only the first three experiments are completed, award Q marks based on Experiments 1 and 2 (as above).		
	(If 50, 45, 40, 35, marks X and XI not available. Use 40 and 20 if there + ‘rescue’ pair as above.)			
	The Examiner is to round all reaction times to the nearest second before awarding accuracy marks. (Volumes FA 1 /expt no as specified in Qn)			

[11]

[11]

Page 3	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	33

(b)	PDO Layout	I Plots rate or (1000/time) on y-axis and volume of FA 1/FA 1 cm ³ on x-axis. Axes correctly labelled.	1	[5]
		II Uniform scales selected. Each scale starts at zero and highest point plotted on each axis has used more than half of the available grid.	1	
		III and Examiner to check all plotted points. IV Points must be correct to ½ small square and in correct small square.	2	
		Award III and IV for correct points for all experiments carried out (minimum 5). Award III only if one mistake made. (If only four expts carried out then all 4 correct.) V Draws a “best-fit” straight line – one that passes close to the majority of points and points are balanced. The line does not have to pass through the origin. (Allow curve if appropriate.)	1	
(c)	ACE Conclusions	Depth (of solution) is greater, ... so time is shorter/less// <u>time</u> is faster//fewer seconds (<i>time is conditional on depth</i>)	1	[2]
		or solution/liquid depth unchanged so reaction time unchanged for 1 mark.	1	
(d)	ACE Interpretation	Give one mark for a concentration of 0.021/0.0214/0.02143 mol dm ⁻³ for expt 5.	1	[2]
	PDO Display	Working shown must include correct use of 70.	1	

Page 4	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	33

(e)	ACE Interpretation	Two pieces of evidence with no conclusion or one piece and conclusion. 2 nd piece of evidence and conclusion.	1	
		Evidence for ‘correct’ (i) a straight line/(line with) constant gradient (ii) straight line passes through origin (if appropriate from results) is 2 pieces of evidence (iii) line passes through origin = 1 if line drawn is straight Evidence for ‘incorrect’ (i) a curve has been drawn/no straight line/not constant gradient (ii) straight line does not pass through the origin (iii) points too scattered/not on best fit line (iv) a curve drawn but expect straight line = 2 <i>A straight line, not passing through the origin could score both marks depending on explanation given (proportional but not directly proportional). If two points are compared they must be on or very close to the graph line.</i>	1	
(f)	ACE Interpretation	Candidate correctly evaluates each % uncertainty.	1	[1]
(g)	ACE Improvement/s	Constant volume of FA 1 .	1	[2]
		Varies volume of FA 2 and water correspondingly (Volume FA 2 + H ₂ O same).	1	
Total			25	

Page 5	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	33

FA 3 is $\text{CuCl}_2(\text{aq})$; **FA 4** is $\text{AlK}(\text{SO}_4)_2(\text{aq}) + \text{KI}(\text{aq})$; **FA 5** is $\text{FeCl}_3(\text{aq})$; **FA 6** is $\text{Pb}(\text{NO}_3)_2(\text{aq})$

2	(a)	MMO Collection	Records a blue / greenish-blue ppt / solid with FA 3 and Na_2CO_3 .	1	[4]
			Records a brown / rust / orange-brown / red-brown ppt / solid with FA 5 and Na_2CO_3 .	1	
			Records effervescence with FA 5 (or FA 3).	1	
		MMO Decisions	Tests <u>gas</u> evolved with limewater. Allow from effervescence.	1	
	(b)	MMO Collection	Records a white precipitate with silver nitrate solution and soluble in aqueous ammonia.	1	[1]
	(c)	MMO Collection	Records yellow-brown / orange-brown / brown / tan colour (solid/solution) (formed on mixing FA 4 and FA 3). Allow dark brown for solution only . Allow (qualified) brown solution with white / off-white / grey ppt. Dark / deep blue / blue-black / black / purple colour on adding starch solution	1 1	[2]
	(d)	MMO Collection	Mark the observations in the table horizontally or vertically to maximise marks available to the candidate.	4	[4]

Test	Observations			
	FA 3	FA 4	FA 5	FA 6
$\text{NaOH}(\text{aq})$	blue ppt not dark/deep blue ppt	white ppt (which dissolves as more added/then dissolves)	red-brown / orange-brown / brown / rust ppt (not dark / deep brown)	white ppt
excess NaOH	ppt insoluble (no change no observation provided ppt above)	ppt soluble (if no ppt in 1 st box allow no change)	ppt insoluble (no change no observation provided ppt above)	ppt soluble (not no change after 'no ppt')
$\text{NH}_3(\text{aq})$	blue ppt not dark/deep blue ppt	white ppt	red-brown / orange-brown / brown / rust ppt (not dark / deep brown)	white ppt
excess ammonia	(ppt soluble) deep blue soln	ppt insoluble (no change no observation provided ppt above)	ppt insoluble (no change no observation provided ppt above)	ppt insoluble (no change no observation provided ppt above)

Page 6	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	33

FA 3 is $\text{CuCl}_2(\text{aq})$; FA 4 is $\text{AlK}(\text{SO}_4)_2(\text{aq}) + \text{KI}(\text{aq})$; FA 5 is $\text{FeCl}_3(\text{aq})$; FA 6 is $\text{Pb}(\text{NO}_3)_2(\text{aq})$					
(e)	ACE Conclusions	Con2	Give one mark for FA 3 Cu^{2+} /copper/copper(II) and FA 5 Fe^{3+} /iron(III).	1	[2]
		Con2	Give one mark for FA 4 and FA 6 Al^{3+} /aluminium, Pb^{2+} /lead Allow FA 4 $\text{Al}^{3+}(\text{Pb}^{2+})$ and FA 6 Al^{3+} , Pb^{2+} (There must be some correct evidence for Cu^{2+} and Fe^{3+} in (d) but does not have to be fully correct.)	1	
(f)	MMO Decisions	De7	Selects appropriate reagent to distinguish between Al^{3+} and Pb^{2+} e.g. KI, K_2CrO_4 , H_2SO_4 , HCl (not BaCl_2).	1	[1]
(g)	ACE Conclusions	Con2	No error carried forward in this section. Award the mark for: FA 3 chloride FA 4 iodide FA 5 insufficient tests	1	[1]
Total				15	

MARK SCHEME for the October/November 2012 series

9701 CHEMISTRY

9701/34

Paper 3 (Advanced Practical Skills), 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

Page 2	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	34

Question	Sections	Indicative material	Mark	
1 (a)	PDO Recording	I Correct units given for time and rates columns: / s or (s) and / s ⁻¹ or (s ⁻¹)	1	[9]
		II Records all 5 times to the nearest second. Do not allow if $t_1 > t_3$.	1	
	PDO Display	III All (1000/time) values are correctly evaluated to 3 sig fig using the candidate's recorded times. (Minimum of 3 experiments carried out.)	1	
	MMO Quality	IV to IX Use the method given in the notes below when awarding the Quality marks.	6	
	Round all reaction times to the nearest second. IV and V Experiments 2 and 4: calculate $100(2t_2 - t_4)/t_4 \leq 20\%$ for 1 mark; $\leq 10\%$ for 2 marks. VI and VII Experiments 2 and 5: calculate $100(4t_2 - t_5)/t_5 \leq 20\%$ for 1 mark; $\leq 10\%$ for 2 marks. VIII and IX Experiments 4 and 5: calculate $100(2t_4 - t_5)/t_5 \leq 30\%$ for 1 mark; $\leq 10\%$ for 2 marks. If the candidate has not completed the 5th experiment, marks IV and V are available. Also check Experiments 1 and 2: t_2 should equal $t_1 \times 5/4$. Use the 10% and 20% boundaries. If only the first three experiments are completed, award Q marks based on Experiments 1 and 2 (as above).			
(b)	PDO Layout	I Plots (1000/time) on y-axis and volume of FB 1 on x-axis. Axes correctly labelled and correct unit included with volume heading.	1	[5]
		II Uniform scales selected and more than half of the available grid used. Scales must start at (0,0).	1	
		III All results are plotted within ½ square and in correct square. Allow for minimum 4 experiments carried out.	1	
		IV Draws a line through the origin (as shown) which lies within the arc of the points.	1	
		V Draws a straight line of best fit (origin not essential).	1	

Page 3	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	34

(c)	ACE Interpretation PDO Display	(i) Experiment 1 and 5: correct concentration (to 2 – 4 sf) of hydrogen peroxide in one of the solutions (0.088/0.0885/0.08846 and 0.018/0.0177/0.01769 respectively). Correct concentrations in both and working shown in one. (ii) Working to show that concentration of H_2O_2 is proportional to volume of FB 1 . Use of ratios or multiplying factor or statement that total volume is constant / the same in each.	1 1 1	[3]
(d)	ACE Conclusions	Two pieces of evidence needed. If website statement correct (i) a straight line / (line has) constant gradient (ii) passes through origin if graph line is straight (iii) straight line passes through origin (if appropriate from results) gains both marks. or If website statement not correct (i) a curve has been drawn / no straight line / not constant gradient (ii) straight line does not pass through the origin (iii) points too scattered / not on best fit line. If no comment on correct / incorrect Allow 1 mark: for two pieces of evidence A straight line, not passing through the origin could score both marks depending on explanation given (proportional but not directly proportional). If two points are compared they must be on or very close to the graph line.	1 1	[2]
(e)	ACE Conclusions	Predicts time will be reduced / halved (reference to rate is incorrect; allow time is faster). Explains that smaller amount / moles / volume of thiosulfate are present to delay blue-black colour / less iodine needs to be produced.	1 1	[2]
(f)	ACE Interpretation	Temperature change / concentration of KI / initial concentration of H_2O_2 . (NOT catalyst)	1	[1]
(g)	ACE Interpretation	(i) Correctly calculates mean = 54.8 only . (ii) Correctly calculates error = 3.6 or 3.65% . Allow ecf correctly calculated from candidate's answer in (i) (3.56 or 3.6% if mean = 56.2).	1 1	[2]
(h)	ACE Improvements	1 st experiment: only FB 2 changes and distilled water adjusted to give 60 cm ³ total and 2 nd experiment: only FB 4 changes and distilled water adjusted to give 55 cm ³ total.	1	[1]
[Total: 25]				

Page 4	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	34

FB 5 is $\text{FeSO}_4(\text{aq})$; **FB 6** is $\text{NH}_4\text{Cl}(\text{aq}) + \text{Na}_2\text{SO}_3(\text{aq})$; **FB 7** is $\text{MgSO}_4(\text{aq})$; **FB 8** is $\text{CH}_3\text{CO}_2\text{Na}(\text{s})$

2	(a)	PDO Recording MMO Collection MMO Decisions	I Records all results (in correct space) for unknowns in a single table. II Records green ppt, insoluble in excess NaOH for FB 5 and white ppt insoluble in excess NaOH with FB 7. III Only heats the solution in which no ppt formed with NaOH. IV Tests <u>gas</u> /NH_3 evolved on heating FB 6 with NaOH with (red) litmus paper turning blue.	1 1 1 1	[4]
	(b)	MMO Collection	With FB 5 records a green ppt, insoluble in excess ammonia and with FB 7 records a white ppt insoluble in excess ammonia. Any evidence of the green ppt with FB 5 turning brown in tests in (a) or (b).	1 1	[2]
	(c)	ACE Conclusions	No ecf in this section. FB 5 contains Fe^{2+}, iron(II) FB 6 contains NH_4^+, ammonium FB 7 contains Mg^{2+}, magnesium	1	[1]
	(d)	MMO Decisions MMO Collection ACE Conclusions	(i) Chooses as reagents: barium chloride / nitrate as first reagent, and hydrochloric / nitric acid as second reagent. (ii) White ppt for all three with first reagent. (Allow off-white ppt with FB 5) FB 5 and FB 7 ppt insoluble and FB 6 ppt dissolves in second reagent. (If acid added before Ba^{2+} then award 3rd mark for white ppt, no reaction, white ppt.) (iii) Correctly identifies the ions present and explanation from observations: SO_4^{2-} in FB 5 and FB 7 as ppt insoluble in (appropriate) acid or SO_3^{2-} in FB 6 as ppt soluble in acid. (Only allow ecf if same transposition of solutions as in (a); SO_3^{2-} must be with NH_4^+)	1 1 1 1	[4]

Page 5	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	34

(e)	MMO Collection	Either solution turns yellow / orange / orange-brown / brown (box 1) or brown / rust / red-brown ppt formed (box 2) (ppt soluble in excess is incorrect). Other of the above and observes effervescence / fizzing / bubbles (in either box). (Allow gas relights glowing splint (in either box) for 3 rd observation.)	1	[2]
			1	
(f)	MMO Collection	Test 1: (blue) litmus paper turns red and Test 2: sweet / fruity / glue / adhesive / nail varnish smell. Accept smell of ester.	1	[2]
	ACE Conclusion	Salt of an organic / carboxylic acid or organic salt / named salt of organic acid or (A solid/crystalline) organic/carboxylic acid/named organic acid.	1	
	[Total:15]			

MARK SCHEME for the October/November 2012 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 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

Page 2	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	35

Question	Sections	Indicative material	Mark	Total
1 (a)	PDO <i>Recording</i>	Table completed and all temperatures recorded to 0.5°C. Must include at least one ending in .0 and one ending in .5.	1	[1]
(b)	(i) PDO <i>Layout</i>	Axes labelled temperature or T / °C or (°C) or temperature in °C (<i>y-axis</i>) and time (<i>x-axis</i>) or t / minutes etc. Linear scales chosen so that graph occupies at least half the available length of both axes. This includes the 5°C extension.	1	[4]
	(ii) PDO <i>Layout</i>	Plotting accurate to within half a small square. Must plot all readings taken – minimum 8.	1	
	MMO <i>Collection</i>	2 straight lines drawn (0 to 3 minutes and 5 to 10 minutes).	1	
	PDO <i>Layout</i>	3 appropriate lines drawn including extrapolations.	1	
(c)	(i) ACE <i>Interpretation</i>	ΔT calculated. Examiner to check from graph and calculate to nearest .5 °C. Candidate's answer must be correct to nearest .5 °C. dp not needed for .0 but can include more sf if appropriate. Allow ΔT at 3 ½ minutes, even if not max, provided some indication on graph.	1	[7]
	(ii) ACE <i>Conclusions</i>	All the magnesium disappeared / reacted / dissolved / gone. Must include idea of totality. (NOT stops fizzing)	1	
	(iii) ACE <i>Interpretation</i>	Error in one temperature reading = 0.5 (°C)	1	
		Maximum % error = $0.5 \times 2 / 7.5 \times 100 = 13.3\%$ (ecf 2 × error). Expression or correct answer but conditional on answer to 1 reading.	1	
	(iv) ACE <i>Improvement</i>	Heat loss and add lid/cover/ top. (allow thermos flask)	1	
	(v) ACE <i>Conclusions</i>	ANY 2 from Higher (initial and) final/ maximum temperature / all temperatures higher. (not temperatures higher) No effect on ΔT . Maximum temperature rise achieved quicker / reacts faster.	1 1	
[Total:12]				

Page 3	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	35

2 (a)	MMO <i>Collection</i>	I Mass of FA 3 used between 1.3 and 1.5 g. Subtraction must be correct from unambiguous weighings.	1	
	PDO <i>Layout</i>	II Records initial and final burette readings and titre for rough. Tabulates and records initial and final burette readings and volume of FA 2 run from burette for all accurate titrations. Not awarded if final is 50 / 50.0 / 50.00 more than once or if 50 etc is used in any initial reading. (One accurate titre is sufficient.)	1	
	PDO <i>Recording</i>	III Appropriate headings and units in accurate titrations. Only acceptable initial / final (burette) reading / volume or reading or volume at start / finish / beginning / end then volume used/volume added / FA 2 used / titre. Units are /cm ³ , (cm ³) or volume in cm ³ .	1	
	PDO <i>Recording</i>	IV All burette readings, apart from the rough, recorded to 0.05 cm ³ (this includes 0.00). Two (minimum) accurate titrations needed.	1	

Examiner to check subtractions, round any burette reading to nearest 0.05 cm³ and then select the best titre using the hierarchy, two identical; two within 0.05 cm³, two within 0.1 cm³ etc., to calculate mean. This Examiner's value should be compared with Supervisor's mean titre taking into account the masses used by the Supervisor and the candidate.

Candidate titre x Supervisor mass/ candidate mass.

The candidate number, candidate's titre, difference from the Supervisor and mark awarded should be recorded on the template. This should be attached securely to the Supervisor's script.

	MMO <i>Quality</i>	V, VI and VII Award V, VI and VII for a mean within 0.20 cm ³ . Award V and VI for a mean >0.20 and ≤0.40 cm ³ . Award V for a mean >0.40 and <0.60 cm ³ . Spread penalty Titres (selected by Examiner) differ by ≥ 0.5 or only one accurate titration –1. This mark is deducted from those awarded in V to VII but no negative marks.	3	[7]
2 (b)	PDO <i>Display</i>	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.	1	

Page 4	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	35

		The mean should normally be quoted to 2 dp rounded to the nearest 0.01. Example: 26.667 must be rounded to 26.67. 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. Do not award this mark if: any selected titre is not within 0.20 cm³ 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]
2	(c) (i)	PDO Display ACE Interpretation	Working shown; mass/106 is minimum required. <u>Candidate's mass of sodium carbonate</u> 106 × 10 Answer correctly calculated to 3 to 4 sf. Allow ecf for transcription error in mass or incorrect <i>M_r</i> but not if volume included.	1	1
	(ii)	ACE Conclusions ACE Interpretation	Correct use of 2. Correct calculation of concentration $\frac{(i) \times 2 \times 1000}{(b)}$ (3 to 4 sf)	1	1
	(iii)	ACE Conclusions	Ecf possible for no 2 or incorrect use of 2. Expression or correct answer to (c)(ii) × 20 (3 to 4 sf only if 20 not shown). Penalise incorrect sf only once.	1	[5]
[Total: 13]					

Page 5	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	35

FA 4 is CuCl ₂ (aq); FA 5 is KMnO ₄ (aq); FA 6 is MnSO ₄ (aq); FA 7 is MnO ₂ .					
3	(a) (i)	MMO Collection	Solution / FA 4 / liquid goes from blue to green or green-yellow / yellow-green.	1	[6]
			(Pale) blue precipitate formed AND dissolves to dark / royal blue solution (not dark / deep blue ppt).	1	
			White precipitate.	1	
			Brown / qualified brown / precipitate / solution (not red-brown or orange) AND goes blue-black or dark blue or black (solution or solid).	1	
	(ii)	ACE Conclusions	FA 4 is copper(II) chloride (one piece of evidence needed for Cu ²⁺ and Ag ⁺ test for Cl ⁻).	1	
	(iii)	ACE Conclusions	Iodide was oxidised (to iodine)/ KI oxidised to iodine / iodine was formed with evidence / KI oxidised needs evidence of iodine. (not iodide is a reducing agent)	1	
(b) (i)	MMO Collection	Solution / FeSO ₄ / liquid goes from green to yellow / green to colourless / stays colourless (not no change). Solution / FA 5 / liquid goes from purple to colourless / purple to yellow. (penalise no solution or initial colour only once in (a)(i) and (b)(i))	1	[9]	
		Buff / off-white / light brown / beige precipitate.	1		
		Goes brown / goes darker brown / black and bubbles / fizzing / (it/gas) relights glowing splint.	1		
		White precipitate AND insoluble in dilute acid.	1		
		Fizzing/bubbles/effervescence and relights a glowing splint (or gas test in point above).	1		
	(ii)	ACE Conclusions	Conclusion: FA 6 is manganese(II) (needs II) (with obs to show some evidence) sulfate (with obs to show some evidence).		1
					1
			Uses NaOH(aq) or NH ₃ (aq).		1
	(iii)	MMO Decisions	Red-brown / orange-brown / dark brown / rust precipitate formed (not red).		1
		ACE Improvements			
[Total: 15]					

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.

Page 2	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	36

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	[6]
	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 $\delta \leq 0.20 \text{ cm}^3$ Award IV and V for $0.20 \text{ cm}^3 < \delta \leq 0.40 \text{ cm}^3$ Award IV for $0.40 \text{ cm}^3 < \delta \leq 0.60 \text{ cm}^3$ Spread penalty Titres (selected by Examiner) differ by $\geq 0.5 \text{ cm}^3$ or only 1 accurate titration penalty -1. This mark is deducted from those awarded in IV to VI but no negative marks.	3	
(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]

Page 3	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	36

(c)	(i)	ACE Interpretation	$\frac{0.1 \times \text{answer to (b)}}{1000}$ calculated correctly (3 to 4 significant figures)	1	[3]
	(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	
(d)		ACE Improvements	Any two from		[2]
			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.		
					[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	[2]
		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	
(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	[4]
	(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	

Page 4	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	36

(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 $3\frac{1}{2}$ min, even if not max, provided some indication on graph.	1	
	(ii)	PDO Display	Correctly calculates $50 \times 4.3 \times$ 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 $\text{Cu}^{2+} = \frac{50 \times 1.1}{1000} = 0.055$ (working must be shown and answer correct to significant figures shown)	1	
	(iv)		$\frac{\text{(c)(ii)}}{1000 \times \text{moles of Zn (from (c)(iii))}}$ (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 = $0.5 (^{\circ}\text{C})$	1	
			Maximum % error = $\frac{1.0 \times 100}{12.0} = 8.3(3) \%$ (ecf $2 \times$ error) Expression or correct answer.	1	[2]
[Total: 14]					

Page 5	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – October/November 2012	9701	36

FB 5 is NiSO ₄ (aq); FB 6 is K ₂ CrO ₄ (aq); FB 7 is H ₂ SO ₄ (aq); FB 8 is BaCl ₂ (aq)					
3 (a)	(i)	MMO Collection	Solution/ FB 5 /liquid goes from green to blue. Green precipitate and insoluble in excess. Unqualified white precipitate, insoluble in acid.	1 1 1	[4]
	(ii)	ACE Conclusions	FB 5 is a sulfate/nickel sulfate/NiSO ₄ /SO ₄ ²⁻ . (allow conclusion even if green ppt in (i))	1	
(b)	(i)	MMO Collection	Solution/ FB 6 /liquid goes from yellow to orange. (Solution) goes green/blue (allow grey-green or blue-green). Yellow precipitate.	1 1 1	[7]
	(ii)	ACE Conclusions	Anion in FB 6 is CrO ₄ ²⁻ / chromate Cation in FB 7 is H ⁺ / hydrogen Cation in FB 8 is Ba ²⁺ / barium or Pb ²⁺ / lead.	1 1 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. Allow ecf from candidate's FB 8 .	1	
(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]					