

MARK SCHEME for the October/November 2013 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.

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Page 2	Mark Scheme	Syllabus	Paper
	GCE A LEVEL – October/November 2013	9701	34

Question	Sections	Indicative material	Mark	Total
1 (a)	MMO Collection	I Initial and final readings and titre value given for rough titre and initial and final readings for two (or more) accurate titrations (<i>minimum of 2 × 2 box</i>)	1	
	PDO Layout	II Appropriate headings and units for all accurate data and volume FB 1 added recorded for each accurate titre. <i>Headings should match readings.</i> <ul style="list-style-type: none"> • initial/start (burette) reading/volume • final/end (burette) reading/volume • titre or volume/FB 1 used/added (<i>but not “difference”</i>) • unit: /cm³ or (cm³) or in cm³ or cm³ for each entry 	1	
	PDO Recording	III All accurate burette readings recorded to 0.05 cm ³ . <i>The need to record to 0.05 applies only to the burette readings and not to the recorded titres.</i> <i>Do not award this mark if:</i> <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). 	1	
	MMO Decisions	IV Has two uncorrected accurate titres within 0.1 cm ³ . <i>Do not include a reading if it is labelled “rough”.</i> <i>Do not award this mark if, having performed two titres within 0.1 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 0.1 cm³ of any other, has also been carried out.</i> <i>Do not award the mark if any ‘accurate’ burette readings (apart from initial 0) are given to zero dp.</i>	1	

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Question	Sections	Indicative material	Mark	Total
1 (a) (cont)		<p>For assessment of accuracy (Q) marks, an Examiner rounds any burette readings to the nearest 0.05 cm^3, checks subtractions and then selects the “best” titres using the hierarchy:</p> <ul style="list-style-type: none"> two (or more) accurate identical titres (ignoring any that are labelled “rough”), <i>then</i> two (or more) accurate titres within 0.05 cm^3, <i>then</i> two (or more) accurate titres within 0.10 cm^3, <i>etc.</i> <p>These best titres are used to calculate the mean titre, to nearest 0.01 cm^3.</p>		
	MMO Quality	<p>Award V, VI and VII for $\delta \leq 0.20 \text{ cm}^3$ Award V and VI for $0.20 < \delta \leq 0.30 \text{ cm}^3$ Award V for $0.30 < \delta \leq 0.50 \text{ cm}^3$ Spread penalty: if the two ‘best’ titres used by the Examiner are $\geq 0.50 \text{ cm}^3$ apart, cancel one Q mark. If Supervisor titre $\leq 15 \text{ cm}^3$ then tolerances are 0.10, 0.20 and 0.30 cm^3.</p>	3	[7]
1 (b)	MMO Decisions	<p>Check mean titre is correctly calculated from clearly selected values (ticks or working).</p> <ul style="list-style-type: none"> Candidate must average two (or more) titres where the total spread is $\leq 0.20 \text{ cm}^3$. 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 dp rounded to the nearest 0.01. [e.g. 26.667 must be rounded to 26.67] <p>Two special cases where the mean may not be to 2 dp: allow mean to 3 dp only for 0.025 or 0.075 eg 26.325; allow mean to 1 dp if all accurate burette readings were given to 1 dp (ignoring initial given as 0) 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.]</p> <p>Do not award this mark if:</p> <ul style="list-style-type: none"> the rough titre was used to calculate the mean; candidate carried out only 1 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. 	1	[1]

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Question	Sections	Indicative material	Mark	Total
1 (c) (i) (ii)	ACE Interpretation	I Correctly calculates answer to $\frac{(b) \times 0.125}{1000}$ in (i) and $\frac{23.25 \times 0.125}{1000} = 0.002906$ (0.00291) in (ii)	1	[6]
(iii)		II Correctly calculates answer to (iii) (ignore sf). If (i) < (ii) then answer must be negative.	1	
(iv) (v)	PDO Display	III Shows use of (iii) $\times 106$ in (iv) and $\times 2$ in (v). (<i>This should be (iii) $\times 2$ but allow (iv) $\times 2$.</i>)	1	
(vi)	ACE Interpretation	IV Correct method [(i) – (v)] $\times 40$ in (vi)	1	
(vii)		V Correct expression: $\frac{(iv)}{[(iv) + (vi)]} \times 100$ in (vii) or correct answer	1	
	PDO Display	VI All quoted answers given to 3 or 4 significant figures except in (iii). (<i>Minimum of 4 answers needed.</i>)	1	
			[Total 14]	

Page 5	Mark Scheme	Syllabus	Paper
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Question	Sections	Indicative material	Mark	Total
2 (a)	PDO Layout	I Presents data in list/form in the space provided. Must have all four required weighings and attempt at mass of solid/ FB 4 or attempt at mass of carbon dioxide.	1	
	PDO Recording	II Gives all appropriate headings and units <ul style="list-style-type: none"> • mass/weight of flask + acid • mass of tube + FB 4 • mass of flask + contents (owtte) • mass of tube + residue/mass of tube • mass of FB 4 • mass of CO₂/mass lost <i>(minimum of four required pieces of information)</i> Units: /g or (g) or in g or g by each entry <i>(Ignore irrelevant data)</i>	1	
		II All recorded balance readings consistent to at least 1 decimal place. <i>(minimum of three balance readings)</i>	1	
	ACE Interpretation	IV Correctly calculates the mass of FB 4 added and the mass of carbon dioxide evolved.	1	
	MMO Quality	V and VI Calculate $\frac{\text{mass FB 4}}{\text{mass of carbon dioxide}}$ to 3 significant figures and compare with Supervisor.		
		Award V and VI for a difference ≤ 0.20 Award V for a difference of $0.20 < \delta \leq 0.50$	2	[6]

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Question	Sections	Indicative material	Mark	Total
2 (b)	ACE Interpretation	(i) Correctly calculates $\frac{\text{mass CO}_2 \text{ from (a)} \times 106}{44}$ to 2 – 4 sf	1	[2]
		(ii) Correct expression $\frac{\text{(b)(i)} \times 100}{\text{mass FB 4 from (a)}}$ or correct answer to 2–4 sf (<i>Do not penalise sf twice.</i>)	1	
2 (c) (i)	ACE Interpretation	Suggests a suitable significant source of error: <ul style="list-style-type: none"> • CO₂ remains dissolved in acid • Impossible to prevent all acid spray • Reaction does not go to completion/ CO₂ not diffused (owtte) from flask • Some FB 4 sticks to the wall of the flask. 	1	
(ii)	ACE Conclusions	Would lower %/decrease since less mass lost/CO ₂ lost/ given out/evolved. Would raise %/increase since more mass lost. Would lower % since less mass lost/CO ₂ produced. Would lower % since less mass lost/used or less CO ₂ produced Explanation must follow source of error. If using 1dp balance then allow cannot tell whether the answer should be greater or smaller/% error could be either way	1	

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Question	Sections	Indicative material	Mark	Total
2 (c)(iii)	ACE Improvement	<p>Improvement suggested must be linked to the error (<i>even if imprecisely expressed</i>) identified in (i).</p> <p>Dissolved CO₂ Saturate the solution with CO₂ before experiment or use warm acid or use less acid.</p> <p>Acid spray Use taller container or cotton wool plug or bung with hole or collect gas in syringe or use less concentrated acid.</p> <p>Going to completion Keep weighing until mass does not go down further or leave for longer or swirl for longer or warm flask and contents or use more concentrated acid.</p> <p>Sticks to side Use beaker or wider-necked flask. If 1dp balance used then allow use balance to 2 or 3 dp.</p>	1	[3]
			[Total 11]	

Page 8	Mark Scheme	Syllabus	Paper
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Question	Sections	Indicative material	Mark	Total
FB 5 is $\text{CuCO}_3(\text{s})$; FB 6 is $\text{Pb}(\text{NO}_3)_2(\text{s})$; FB 7 is ethanedioic (oxalic) acid				
3 (a) (i)	MMO Collection	Blue solution with FB 5 and colourless solution with FB 6 and (rapid) fizzing/bubbling/effervescence with FB 5 .	1	
	MMO Decisions	Describes the test on gas from FB 5 with limewater with positive outcome or gas pops with lighted splint in (b)(i) .	1	

expected observations for **3(a)(ii)**

test	FB 5	FB 6
+ NaOH	(pale) blue ppt insoluble in excess	white ppt soluble in excess
+ NH_3	(pale) blue ppt (soluble in excess) forming deep/dark blue solution	white ppt insoluble in excess
+ KI	brown (yellow-brown/orange-brown, red-brown) ppt/solid/mixture or off-white ppt with brown solution	yellow ppt

Question	Sections	Indicative material	Mark	Total
3 (a)(ii)	MMO Collection	FB 5 correct observations with NaOH	1	
		FB 5 correct observations with NH_3	1	
(iii)	ACE Conclusions	FB 6 correct observations with NaOH and ammonia	1	
		KI correct observations with FB 5 and FB 6	1	
(iv)		FB 5 contains Cu^{2+}	1	
		FB 6 contains Pb^{2+} (with some evidence)	1	
		CO_3^{2-} is anion in FB 5 as fizzing / positive limewater test or some valid statement about the anion in FB 6 e.g. could not be carbonate/sulfite as no fizz / could be nitrate as lead nitrate soluble/ not halide/sulfate/sulfite as lead halide/ PbSO_4 insoluble or no anion tests carried out so no conclusion possible	1	[9]

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(b) (i)	MMO Collection	effervescence between solution and Mg ribbon manganate(VII) decolourised	1 1	[6]
	ACE Conclusions	FB 7 is an acid and a reducing agent.	1	
	(ii)	MMO Collection	(ii) Any two of <ul style="list-style-type: none"> • condensation near mouth of tube or steam produced • liquid at bottom of tube/solid melts/solid dissolves/gives colourless solution • charring in the solid/turning black. 	
(iii)	ACE Conclusions	(iii) FB 7 is organic or simple covalent/molecular or FB 7 is hydrated/has water of crystallisation or undergoes thermal decomposition.	1	
				[Total 15]