CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

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.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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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 (*minimum of 2 × 2 box*)	1	
	PDO Layout	**II** Appropriate headings and units for all accurate data **and** volume **FB 1** added recorded for each accurate titre. *Headings should match readings.* • initial/start (burette) reading/volume • final/end (burette) reading/volume • titre **or** volume/**FB 1** used/added *(but not "difference")* • unit: /cm^3 **or** (cm^3) **or** in cm^3 **or** cm^3 for **each** entry	1	
	PDO Recording	**III** **All** accurate burette readings recorded to 0.05 cm^3. *The need to record to 0.05 applies only to the burette readings and **not** to the recorded titres.* *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).*	1	
	MMO Decisions	**IV** Has two uncorrected accurate titres within 0.1 cm^3. *Do **not** include a reading if it is labelled "rough".* *Do **not** award this mark if, having performed two titres within 0.1 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 0.1 cm^3 of any other, has also been carried out.* *Do **not** award the mark if any 'accurate' burette readings (apart from initial 0) are given to **zero** dp.*	1	

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Question	Sections	Indicative material	Mark	Total
1 (a) (cont)	**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: • two (or more) accurate identical titres (ignoring any that are labelled "rough"), *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, to nearest 0.01 cm^3.			
	MMO Quality	Award **V, VI** and **VII** for $\delta \leqslant 0.20$ cm^3 Award **V** and **VI** for $0.20 < \delta \leqslant 0.30$ cm^3 Award **V** for $0.30 < \delta \leqslant 0.50$ cm^3 Spread penalty: if the two 'best' titres used by the Examiner are $\geqslant 0.50$ cm^3 apart, cancel one Q mark. If Supervisor titre $\leqslant 15$ cm^3 then tolerances are 0.10, 0.20 and 0.30 cm^3.	3	[7]
1 (b)	MMO Decisions	Check mean titre is correctly calculated from clearly selected values (ticks or working). • Candidate must average two (or more) titres where the **total** spread is $\leqslant 0.20$ 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*] 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*.] Do **not** award this mark if: • 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 $\frac{\textbf{(b)} \times 0.125}{1000}$ in **(i)** **and** $\frac{23.25 \times 0.125}{1000} = 0.002906$ (0.00291) in **(ii)**	1	
(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)** × 106 in **(iv)** **and** × 2 in **(v)**. (*This should be* **(iii)** × 2 *but allow* **(iv)** × 2.)	1	
(vi)	ACE Interpretation	**IV** Correct method [**(i)** – **(v)**] × 40 in **(vi)**	1	
(vii)		**V** Correct expression: $\frac{\textbf{(iv)}}{\textbf{[(iv)+(vi)]}} \times 100$ in **(vii)** **or** correct answer	1	[6]
	PDO Display	**VI** All quoted answers given to 3 or 4 significant figures except in **(iii)**. (*Minimum of 4 answers needed.*)	1	
				[Total 14]

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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 • 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 CO_2/mass lost (*minimum of four required pieces of information*) Units: /g or (g) or in g or g by **each** entry (*Ignore irrelevant data*)	1	
		II **All** recorded balance readings consistent to at least 1 decimal place. (*minimum of **three** balance readings*)	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 $\frac{\textbf{mass FB 4}}{\textbf{mass of carbon dioxide}}$ 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 $\frac{\text{mass } CO_2 \text{ from } \mathbf{(a)} \times 106}{44}$ to 2 – 4 sf	1	[2]
		(ii) Correct expression $\frac{\mathbf{(b)(i)} \times 100}{\text{mass } \mathbf{FB\ 4} \text{ from } \mathbf{(a)}}$ **or** correct answer to 2–4 sf (*Do not penalise sf twice.*)	1	
2 (c) (i)	ACE Interpretation	Suggests a suitable significant source of error: • CO_2 remains dissolved in acid • Impossible to prevent all acid spray • Reaction does not go to completion/ CO_2 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	Improvement suggested must be linked to the error (*even if imprecisely expressed*) identified in **(i)**. **Dissolved CO_2** Saturate the solution with CO_2 before experiment **or** use warm acid **or** use less acid. **Acid spray** Use taller container **or** cotton wool plug or bung with hole **or** collect gas in syringe **or** use less concentrated acid. **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. **Sticks to side** Use beaker **or** wider-necked flask. **If** 1dp balance used then allow use balance to 2 or 3 dp.	1	[3]
				[Total 11]

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Question	Sections	Indicative material	Mark	Total
FB 5 is $CuCO_3$(s); **FB 6** is $Pb(NO_3)_2$(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 **FB 5** correct observations with NH_3 **FB 6** correct observations with NaOH **and** ammonia KI correct observations with **FB 5 and FB 6**	1 1 1 1	[9]
(iii)	ACE Conclusions	**FB 5** contains Cu^{2+} **FB 6** contains Pb^{2+} (with some evidence)	1 1	
(iv)		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	

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(b) (i)	MMO Collection ACE Conclusions	effervescence between solution and Mg ribbon manganate(VII) decolourised **FB 7** is an acid **and** a reducing agent.	1 1 1	
(ii)	MMO Collection	**(ii) Any two of** • 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.	 1 1	
(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	[6]
				[Total 15]

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