

MARK SCHEME for the May/June 2014 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 May/June 2014 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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	GCE AS/A LEVEL – May/June 2014	9701	34

Question	Sections	Indicative material	Mark	Total
1 (a)	PDO Layout	I Unambiguous headings for 2 balance readings and volume of FB 2 added between 47.5 and 48.5 cm ³	1	
	MMO Collection	II 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 Recording	III Appropriate headings and units for all accurate data. and volume FB 3 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 3 used/added (<i>not “difference”</i>) unit: /cm³ or (cm³) or in cm³ or cm³ for each entry 	1	
	MMO Decisions	IV 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	
		V Has two uncorrected, accurate titres within 0.1 cm ³ <i>Do not include a reading labelled ‘rough’.</i> <i>Do not award this mark if, having performed two titres within 0.1 cm³, a further titration is performed that is more than 0.1 cm³ from the closer of the two initial titres unless further titrations 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	

Round any burette readings to the nearest 0.05 cm³.
Check and correct subtractions in the titre table.
Examiner then selects the “best” titre using the hierarchy:
two identical; titres within 0.05 cm³; titres within 0.1 cm³; etc.
Candidate scaled titre calculated as:

$$\text{Scaled titre} = \frac{\text{Cand titre} \times \text{Cand} \{ (V_{\text{added}}/500) - 1.6 \times \text{mass}/100.1 \}}{\text{Supervisor} \{ (V_{\text{added}}/500) - 1.6 \times \text{mass}/100.1 \}}$$

Examiner compares candidate scaled titre with Supervisor’s titre.

(a)	MMO Quality	Award VI, VII, VIII and IX for $\delta \leq 0.40 \text{ cm}^3$ Award VI, VII and VIII for $0.40 \text{ cm}^3 < \delta \leq 0.80 \text{ cm}^3$ Award VI and VII for $0.80 \text{ cm}^3 < \delta \leq 1.20 \text{ cm}^3$ Award VI only for $1.20 \text{ cm}^3 < \delta \leq 2.00 \text{ cm}^3$ <i>If the “best” titres are $\geq 0.50 \text{ cm}^3$ apart cancel one of the Q marks.</i>	4	[9]
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Question	Sections	Indicative material	Mark	Total
(b)	ACE Interpretation	<p>Candidate must average two (or more) titres that are all within 0.20 cm³. Working must be shown or ticks must be put next to the two (or more) accurate readings selected.</p> <p><i>The mean should normally be quoted to 2 dp rounded to the nearest 0.01.</i></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><i>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.</i></p>	1	[1]
(c) (i)&(ii)	ACE Interpretation	I Correctly calculates $\frac{0.200 \times 25}{1000} = 5 \times 10^{-3}$ in (i) and gives 5×10^{-3} in (ii)	1	[7]
(iii)		II Uses (ii) $\times \frac{250}{(b)}$ in (iii)	1	
(iv)		III Correct expression $\frac{2.00 \times V \text{ diluted}}{1000}$ in (iv)	1	
(v)&(vi)		IV Correct expressions (iv) – (iii) in (v) and (v) $\div 2$ in (vi)	1	
(vii)		V (vi) $\times 100.1$ (allow $\times 100$) in (vii)	1	
(2 marks)		VI (answer \div correct mass FB 1) $\times 100$ in (vii)	1	
	PDO Display	VII Answers to steps (iii) to (vii) given to 3 or 4 sf <i>minimum number of steps attempted = 4 to access this mark</i>	1	
(d) (i)	ACE Interpretation	smallest = 48.40, largest = 48.60	1	[3]
(ii)	Conclusion	<p>Correct link between volume of FB 2 used/in excess/ concentration of remaining FB 2 and titre or between concentration/volume FB 3/HCl remaining/in excess and titre. (higher volume/concentration gives smaller titre ora)</p> <p>Correct reference to student(s) X and/or Y</p>	1	
			1	
Qn 1	Total		[20]	

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Question	Sections	Indicative material	Mark	Total
2 (a)	PDO Recording	<p>Headings with units for all four balance readings are tabulated clearly.</p> <ul style="list-style-type: none"> mass of crucible mass of crucible + FB 5 mass of crucible + contents/residue/solid/FB5 after heating/cooling mass of crucible + contents/residue/solid/FB5 after re-heating/re-cooling/2nd heating/2nd cooling <p>Mass /g, (g), in g, in grams <i>If units are omitted from the headings then they must appear next to each entry in the table.</i></p> <p>Records all balance readings to a consistent number of dp (minimum 1 dp and minimum 3 balance readings) and records mass of FB 5 (at start) and mass of solid remaining owtte Headings for the two masses of solid must be unambiguous.</p>	1 1	[2]
(b) (i)	ACE Interpretation	Correct mass loss from results in (a)	1	[3]
(ii)	PDO Display	Shows correct use of 100.1 and 44: $\frac{(i) \times 100.1}{44}$	1	
(iii)	ACE Interpretation	calculates $\frac{\text{ans (ii)}}{\text{mass FB 5}} \times 100$	1	
(c) (i)	ACE Conclusion	<p>Thermal decomposition is less accurate because not all carbonate has decomposed. Temperature used not high enough to decompose solid Percentage of CaCO₃ is much less in Question 2</p>	1	[2]
(ii)	Improvement	<p>Heat to constant mass. Use a gas/Bunsen burner/furnace</p> <p>If candidates achieve constant mass and give titration less accurate as more steps then award 1 mark.</p>	1	
Qn 2	Total			[7]

Page 5	Mark Scheme	Syllabus	Paper
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Question	Sections	Indicative material	Mark	Total
FB 6 is $\text{MgSO}_4 + \text{HNO}_3(\text{aq})$; FB 7 is $\text{ZnCO}_3(\text{s}) + \text{KI}(\text{s})$				
3 (a)	MMO Collection	I White ppt with NH_3 insoluble in excess	1	[6]
		II No visible reaction/no change and White ppt	1	
	ACE Conclusion	III Mg^{2+} and Al^{3+} and SO_4^{2-} and/or SO_3^{2-} in (iv)	1	
	MMO Decisions	IV Selects NaOH in (v) . (Allow KI/ HCl/ H_2SO_4 / K_2CrO_4 if Pb^{2+} in (iv))	1	
	Collection	V White ppt insoluble in excess (NaOH) (Allow no reaction with KI if Pb^{2+} in (iv))	1	
	ACE Conclusion	VI (not) Al^{3+} / Mg^{2+} is present Allow ecf from incorrect <u>cations</u> in (iv) and correct observation with NaOH	1	
(b) (i) (ii) (iii) (iv) (v)	MMO Collection	I Solid turns yellow on heating and paler yellow/white on cooling	1	[7]
		II Effervescence and gas turns limewater milky (or in (i))	1	
		III (Solution turns) (darker) yellow/orange/red/brown and blue/black with starch	1	
		IV (Pale) yellow ppt	1	
	ACE Conclusion	V White ppt soluble in excess	1	
		VI and VII Identifies all three ions (Zn^{2+} , CO_3^{2-} and I^-) VI only Identifies two ions. Minimum evidence: Zn^{2+} white ppt soluble in excess NH_3 CO_3^{2-} effervescence or positive limewater I^- either (iii) or (iv) correct	1 1	
Qn 3	Total		[13]	