

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
GCE Advanced Subsidiary Level and GCE Advanced Level

## **MARK SCHEME for the May/June 2014 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 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	31

Question	Sections	Indicative material	Mark	Total
1 (a)	PDO Layout	<b>I</b> Initial and final readings and titre value given for rough titre <b>and</b> initial and final readings for two (or more) accurate titrations ( <i>minimum of 2 × 2 box</i> )	1	
	PDO Recording	<b>II</b> Appropriate headings and units for all accurate data. <b>and</b> volume <b>FA 1</b> added recorded for each accurate titre. <i>Headings should match readings.</i> <ul style="list-style-type: none"> <li>initial/start (burette) reading/volume</li> <li>final/end (burette) reading/volume</li> <li>titre <b>or</b> volume/<b>FA 1</b> used/added (<b>not</b> “difference”) unit: /cm<sup>3</sup> <b>or</b> (cm<sup>3</sup>) <b>or</b> in cm<sup>3</sup> <b>or</b> cm<sup>3</sup> for <b>each</b> entry</li> </ul>	1	
	MMO Decisions	<b>III All</b> accurate burette readings recorded to 0.05 cm <sup>3</sup> . <i>The need to record to 0.05 applies only to the burette readings and <b>not</b> to the recorded titres.</i> <i>Do <b>not</b> award this mark if:</i> <ul style="list-style-type: none"> <li>50.(00) is used as an initial burette reading</li> <li>more than one final burette reading is 50.(00)</li> <li>any burette reading is greater than 50.(00).</li> </ul>	1	
<p>Examiner rounds burette readings to the nearest 0.05 cm<sup>3</sup>, checks subtractions and then selects the ‘best’ titres using the hierarchy: two (or more) identical, then two (or more) within 0.05 cm<sup>3</sup>, then two (or more) within 0.1 cm<sup>3</sup>, etc. Examiner compares candidate mean titre with Supervisor mean titre.</p>				
(a)	MMO Quality	Award <b>V</b> and <b>VI</b> for difference from Supervisor, $\delta \leq 0.20 \text{ cm}^3$ Award <b>V</b> only for $0.20 < \delta \leq 0.40 \text{ cm}^3$ <i>Spread penalty: if the two ‘best’ titres are <math>\geq 0.50 \text{ cm}^3</math> apart cancel one of the Q marks.</i>	2	[6]

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Question	Sections	Indicative material	Mark	Total
(b)	ACE Interpretation	<p>Candidate must average two (or more) titres that are within <math>0.20 \text{ cm}^3</math>. 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 <b>all</b> 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)	ACE Interpretation  PDO Display  ACE Interpretation  PDO Display	<p><b>I</b> Correctly evaluates <math>\frac{0.0200 \times (\mathbf{b})}{1000}</math> in <b>(i)</b></p> <p><b>II</b> Correctly evaluates <math>\frac{(\mathbf{i}) \times 5/2}{25}</math> in <b>(iii)</b></p> <p><b>III</b> Correct balanced equation in <b>(iv)</b></p> <p><b>IV</b> Correctly evaluates <math>\text{ans } (\mathbf{iii}) \times \frac{1}{2} \times 24.0</math> in <b>(v)</b> (Allow ecf from incorrect equation)</p> <p><b>V</b> All answers given to 3 or 4 sf (minimum of 3 answers attempted)</p>	1  1  1  1	[5]
<b>Qn 1</b>	<b>Total</b>			<b>[12]</b>

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Question	Sections	Indicative material	Mark	Total
2 (a)	PDO Recording	<p><b>I</b> Table to include</p> <ul style="list-style-type: none"> <li>• volume of hydrogen peroxide/<b>FA 2</b>,</li> <li>• volume of potassium iodide/<b>FA 4</b>,</li> <li>• volume of distilled water,</li> <li>• reaction time.</li> </ul> <p>volume/V in cm<sup>3</sup>//cm<sup>3</sup>/ (cm<sup>3</sup>), time/t in seconds//s/(s). (Minimum 2 expts recorded)</p>	1	[6]
		<p><b>II</b> All times recorded to the nearest second. (Minimum 2 expts)</p>	1	
	ACE Interpretation	<p><b>III</b> Correctly calculates all three rates (allow to 2 or 3 sf)</p> <p>Compare times for Expts 1 and 3 with those of the Supervisor.</p>	1	
	MMO Quality	<p>Award <b>IV</b>, <b>V</b> and <b>VI</b> for both times within 3 s Award <b>IV</b> and <b>V</b> for one within 3 s and one within 6 s Award <b>IV</b> only for either within 6 s (If only 2 expts carried out <b>IV</b> is available – from either expt performed)</p>	3	
(b)	ACE Conclusion	Rate increases with increasing concentration of hydrogen peroxide and potassium iodide (ora). Allow ecf from candidate's results.	1	[1]
(c)	MMO Decisions	<p>Selects different volumes of <b>FA 4</b> (less than 20 cm<sup>3</sup>, not 10 cm<sup>3</sup> and not closer than 2 cm<sup>3</sup> to suggested volumes or to 20 cm<sup>3</sup> or to 10 cm<sup>3</sup>)</p>	1	[2]
		<p>Volumes of distilled water selected so that vol of water + vol of <b>FA 4</b> = 20 cm<sup>3</sup> <b>and</b> <b>FA 2</b> = 20 cm<sup>3</sup> If <b>FA 3</b> and <b>FA 5</b> are shown then the volumes must be constant.</p>	1	
(d)	ACE Improvements	<p>Reason: change of temperature Use water bath to maintain constant temperature</p>	1	[2]
		<p>Reason: decomposition of hydrogen peroxide Store H<sub>2</sub>O<sub>2</sub>(aq) in the fridge, make up fresh H<sub>2</sub>O<sub>2</sub>(aq), check conc. of H<sub>2</sub>O<sub>2</sub>(aq), keep H<sub>2</sub>O<sub>2</sub>(aq) in dark/dim light.</p>	1	
(e) (i)	ACE Interpretation	<p>Expression <math>\frac{1}{\text{time from Expt 1}} \times 100</math> <b>or</b> correct value.</p>	1	[2]
		<p>(Higher conc. of thiosulfate means) greater reaction time (allow reaction will be slower) <b>and</b> so a smaller percentage error.</p>	1	
<b>Qn 2</b>	<b>Total</b>			<b>[13]</b>

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Question	Sections	Indicative material	Mark	Total	
<b>FA 6</b> is ZnSO <sub>4</sub> (aq) and NaBr(aq); <b>FA 7</b> is FeSO <sub>4</sub> (aq)					
<b>3 (a)</b>	<b>(i)</b> MMO Decisions  PDO Layout  MMO Collection  ACE Conclusion	<b>I</b> Selects NaOH(aq) and NH <sub>3</sub> (aq), and uses each in excess	1		
		<b>II</b> Unambiguous layout of all 4 observations (excess must be stated).	1		
		<b>III</b> White ppt with NaOH and soluble in excess.	1		
		<b>IV</b> White ppt with NH <sub>3</sub> soluble in excess.	1		
		<b>V</b> Zn <sup>2+</sup>	1		
	<b>(ii)</b> MMO Collection  ACE Conclusion	<b>VI</b> Cream ppt with AgNO <sub>3</sub> <b>and</b> partially sol / insol in NH <sub>3</sub>	1		
		<b>VII</b> White ppt with BaCl <sub>2</sub> /Ba(NO <sub>3</sub> ) <sub>2</sub> <b>and</b> insol in nitric acid.	1		
		<b>VIII</b> Br <sup>-</sup>	1		
		<b>IX</b> SO <sub>4</sub> <sup>2-</sup>	1		
<b>[9]</b>					
<b>(b)</b>	<b>(i)</b> MMO Collection	<b>I</b> Green ppt turning brown (in contact with air)	1		
		<b>(ii)</b>	<b>II</b> No reaction/no change <b>or</b> yellow or green solution		1
		<b>(iii)</b>	<b>III</b> Red-brown/brown/green-brown ppt <b>and</b> effervescence		1
		<b>IV</b> Gas relights a glowing splint	1		
	<b>(iv)</b> ACE Conclusion	<b>V</b> Redox	1		
		<b>(v)</b>	<b>VI</b> Decomposition of hydrogen peroxide to give oxygen <b>or</b> ppt is Fe(OH) <sub>3</sub> / oxidation of Fe <sup>2+</sup> to Fe <sup>3+</sup>		1
<b>[6]</b>					
<b>Qn 3</b>	<b>Total</b>		<b>[15]</b>		