

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International Advanced Level

## **MARK SCHEME for the May/June 2015 series**

### **9701 CHEMISTRY**

**9701/53**

Paper 5 (Planning, Analysis and Evaluation),  
maximum raw mark 30

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.

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – May/June 2015	9701	53

Question	Statement	Expected Answer	Mark
1 (a) (i)	M10	$\text{HCOO}^- (\text{aq}) \longrightarrow \text{CO}_2(\text{g}) + \text{H}^+(\text{aq}) + 2\text{e}^-$ $\text{MnO}_4^- (\text{aq}) + 8\text{H}^+(\text{aq}) + 5\text{e}^- \longrightarrow \text{Mn}^{2+}(\text{aq}) + 4\text{H}_2\text{O}(\text{l})$	[1] [1]
(ii)	M6	Magnesium methanoate is $1.312 \text{ mol dm}^{-3}$  $[\text{HCOO}^- (\text{aq})] = 2.624 \text{ mol dm}^{-3}$	[1]  [1]
(iii)	M6	Use <u>volumetric apparatus</u> (to measure $5.0 \text{ cm}^3$ / saturated (magnesium) methanoate solution).  Make (the above) up to the mark (with water) in a $250 \text{ cm}^3$ volumetric / graduated flask	[1]  [1]
(iv)	M3/P4	$\text{H}^+$ is needed for the reaction with manganite  Provided the acid is in excess / sufficient / enough, the volume does not matter	[1]  [1]
(v)	M5	A <b>pale</b> pink colour	[1]
(vi)	M10	$0.051 \text{ mol dm}^{-3}$	[1]
(vii)	M10	$1.28 \text{ mol dm}^{-3}$	[1]

Page 3	Mark Scheme	Syllabus	Paper
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Question	Statement	Expected Answer	Mark
(b)	P1/P2	(Independent) Temperature (Dependent) Concentration of magnesium methanoate	[1]
(c)	P3	$\Delta H$ is positive	[1]
		(An increase in temperature) will favour / promote / increase / a movement in the direction of the endothermic change / reaction	[1]
(d)	P3	<b>Precipitate is formed</b> / barium sulfate is <b>insoluble</b> / <b>insoluble product</b>	[1]
			<b>[15]</b>
2 (a) (i)	D1	$K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$	[1]
(ii)	D1	$K_c = \frac{4y^2}{(a - y)^2}$	[1]

Page 4	Mark Scheme	Syllabus	Paper
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Question	Statement	Expected Answer	Mark																																				
(b) (i)	D3	<table border="1"> <thead> <tr> <th>a mol dm<sup>-3</sup></th> <th>a – y mol dm<sup>-3</sup></th> <th>y mol dm<sup>-3</sup></th> </tr> </thead> <tbody> <tr><td>0.200</td><td>0.022</td><td>0.178</td></tr> <tr><td>0.500</td><td>0.050</td><td>0.450</td></tr> <tr><td>0.800</td><td>0.252</td><td>0.548</td></tr> <tr><td>1.000</td><td>0.200</td><td>0.800</td></tr> <tr><td>1.500</td><td>0.365</td><td>1.135</td></tr> <tr><td>2.100</td><td>0.570</td><td>1.530</td></tr> <tr><td>2.800</td><td>0.652</td><td>2.148</td></tr> <tr><td>3.400</td><td>0.700</td><td>2.700</td></tr> <tr><td>3.800</td><td>0.867</td><td>2.933</td></tr> <tr><td>4.200</td><td>0.868</td><td>3.332</td></tr> <tr><td>4.900</td><td>1.150</td><td>3.750</td></tr> </tbody> </table>	a mol dm <sup>-3</sup>	a – y mol dm <sup>-3</sup>	y mol dm <sup>-3</sup>	0.200	0.022	0.178	0.500	0.050	0.450	0.800	0.252	0.548	1.000	0.200	0.800	1.500	0.365	1.135	2.100	0.570	1.530	2.800	0.652	2.148	3.400	0.700	2.700	3.800	0.867	2.933	4.200	0.868	3.332	4.900	1.150	3.750	[1] [1]
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All results for y are to 3 decimal places All values for y are correct																																							
(ii)	D1	All points plotted correctly	[1]																																				
(iii)	E5	Appropriate straight line drawn through the origin	[1]																																				

Page 5	Mark Scheme	Syllabus	Paper
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Question	Statement	Expected Answer	Mark
(c) (i)	D3/C1	Co-ordinates read correctly from the line	[1]
		Slope of the graph calculated correctly and given to <b>three significant figures</b> with no units.	[1]
(ii)	D3/C1	Uses $\frac{\sqrt{K_c}}{2 + \sqrt{K_c}}$ = gradient (value or y/a) and provides working	[1]
		Gives value of $K_c$	[1]
(d)	P4	The hydrogen with air / oxygen is explosive at 760K / raised temperature	[1]
(e)	E4	Faster reaction / increased rate	[1]
		The value of $K_c$ would be unaffected	[1]
(f) (i)	E4/C2	The line drawn on the graph has a less steep gradient	[1]
(ii)		The equilibrium constant will be smaller	[1]
			[15]