

**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

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<b>Question</b>	<b>Statement</b>	<b>Expected Answer</b>	<b>Mark</b>
<b>1 (a) (i)</b>	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]
<b>(ii)</b>	M6	Magnesium methanoate is $1.312 \text{ mol dm}^{-3}$  $[\text{HCOO}^- (\text{aq})] = 2.624 \text{ mol dm}^{-3}$	[1]  [1]
<b>(iii)</b>	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]
<b>(iv)</b>	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]
<b>(v)</b>	M5	A <b>pale</b> pink colour	[1]
<b>(vi)</b>	M10	$0.051 \text{ mol dm}^{-3}$	[1]
<b>(vii)</b>	M10	$1.28 \text{ mol dm}^{-3}$	[1]

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<b>Question</b>	<b>Statement</b>	<b>Expected Answer</b>	<b>Mark</b>
<b>(b)</b>	P1/P2	(Independent) Temperature (Dependent) Concentration of magnesium methanoate	[1]
<b>(c)</b>	P3	$\Delta H$ is positive (An increase in temperature) will favour / promote / increase / a movement in the direction of the endothermic change / reaction	[1] [1]
<b>(d)</b>	P3	<b>Precipitate is formed</b> / barium sulfate is <b>insoluble</b> / <b>insoluble product</b>	[1]
			<b>[15]</b>
<b>2 (a) (i)</b>	D1	$K_c = \frac{[HI]^2}{[H_2][I_2]}$	[1]
<b>(ii)</b>	D1	$K_c = \frac{4y^2}{(a-y)^2}$	[1]

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<b>Question</b>	<b>Statement</b>	<b>Expected Answer</b>	<b>Mark</b>																																				
<b>(b) (i)</b>	<b>D3</b>	<table border="1"> <thead> <tr> <th><b>a mol dm<sup>-3</sup></b></th> <th><b>a – y mol dm<sup>-3</sup></b></th> <th><b>y mol dm<sup>-3</sup></b></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>	<b>a mol dm<sup>-3</sup></b>	<b>a – y mol dm<sup>-3</sup></b>	<b>y mol dm<sup>-3</sup></b>	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	<p>[1] [1]</p>
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<b>(ii)</b>	<b>D1</b>	All points plotted correctly	[1]																																				
<b>(iii)</b>	<b>E5</b>	Appropriate straight line drawn through the origin	[1]																																				

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<b>Question</b>	<b>Statement</b>	<b>Expected Answer</b>	<b>Mark</b>
<b>(c) (i)</b>	<b>D3/C1</b>	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]
<b>(ii)</b>	<b>D3/C1</b>	Uses $\frac{\sqrt{K_c}}{2 + \sqrt{K_c}}$ = gradient (value or y/a) and provides working	[1]
		Gives value of $K_c$	[1]
<b>(d)</b>	<b>P4</b>	The hydrogen with air / oxygen is explosive at 760K / raised temperature	[1]
<b>(e)</b>	<b>E4</b>	Faster reaction / increased rate	[1]
		The value of $K_c$ would be unaffected	[1]
<b>(f) (i)</b>	<b>E4/C2</b>	The line drawn on the graph has a less steep gradient	[1]
<b>(ii)</b>		The equilibrium constant will be smaller	[1]
			<b>[15]</b>