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Cambridge International Advanced Level

MARK SCHEME for the May/June 2015 series

9701 CHEMISTRY

9701/51 Paper 5 (Planning, Analysis and Evaluation), maximum raw mark 30

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Question	Statement	Expected Answer	Mark
1 (a) (i)	M10	$HCOO^-(aq) \longrightarrow CO_2(g) + H^+(aq) + 2e^-$ $MnO_4^-(aq) + 8H^+(aq) + 5e^- \longrightarrow Mn^{2+}(aq) + 4H_2O(l)$	[1] [1]
(ii)	M6	Magnesium methanoate is 1.312 mol dm^{-3} $[HCOO^-(aq)] = 2.624$ mol dm^{-3}	[1] [1]
(iii)	M6	Use <u>volumetric apparatus</u> (to measure 5.0 cm^3 / saturated (magnesium) methanoate solution). Make (the above) up to the mark (with water) in a 250 cm^3 volumetric / graduated flask	[1] [1]
(iv)	M3/P4	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 **<u>pale</u>** pink colour	[1]
(vi)	M10	0.051 mol dm^{-3}	[1]
(vii)	M10	1.28 mol dm^{-3}	[1]

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

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<table>
<tr><th>Question</th><th>Statement</th><th>Expected Answer</th><th>Mark</th></tr>
<tr><td>(b) (i)</td><td>D3</td><td>
<table>
<tr><th>a mol dm^{-3}</th><th>a – y mol dm^{-3}</th><th>y mol dm^{-3}</th></tr>
<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>
</table>
All results for y are to 3 decimal places
All values for y are correct
</td><td>[1]
[1]</td></tr>
<tr><td>(ii)</td><td>D1</td><td>All points plotted correctly</td><td>[1]</td></tr>
<tr><td>(iii)</td><td>E5</td><td>Appropriate straight line drawn through the origin</td><td>[1]</td></tr>
</table>

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Question	Statement	Expected Answer	Mark
(c) (i)	D3/C1	Co-ordinates read correctly from the line Slope of the graph calculated correctly and given to **three significant figures** with no units.	[1] [1]
(ii)	D3/C1	Uses $\frac{\sqrt{K_c}}{2+\sqrt{K_c}}$ = gradient (value or y / a) and provides working Gives value of K_c	[1] [1]
(d)	P4	The hydrogen with air / oxygen is explosive at 760K / raised temperature	[1]
(e)	E4	Faster reaction / increased rate The value of K_c would be unaffected	[1] [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]

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