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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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CAMBRIDGE
International Examinations

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]

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]

<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>

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]