

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International Advanced Level

## **MARK SCHEME for the October/November 2014 series**

### **9701 CHEMISTRY**

**9701/53**

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

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<b>Question</b>	<b>Expected Answer</b>	<b>Additional Guidance</b>	<b>Mark</b>	
<b>1 (a) (i)</b>	$\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2$		<b>1</b>	
<b>(ii)</b>	$2\text{Al} + 3\text{H}_2\text{SO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{H}_2$		<b>1</b>	<b>[2]</b>
<b>(b) (i)</b>	The mass of magnesium		<b>1</b>	<b>[1]</b>
<b>(ii)</b>	The <b>temperature</b> change		<b>1</b>	<b>[1]</b>
<b>(c) (i)</b>	12.35 cm <sup>3</sup> ECF equation in (a)		<b>1</b>	<b>[1]</b>
<b>(ii)</b>	The sulfuric acid must be in excess <b>OR</b> to ensure all the Mg has reacted / disappeared / dissolved / is the limiting reagent		<b>1</b>	<b>[1]</b>
<b>(d)</b>	mol of Al = 0.011 (mol) <b>AND</b> mol of sulfuric acid = 0.0167 (mol)  Volume of sulfuric acid = 16.67 cm <sup>3</sup>		<b>1</b>  <b>1</b>	<b>[2]</b>
<b>(e) (i)</b>	The volume / mass of sulfuric acid / solution <b>OR</b> a stated volume of sulfuric acid. <b>AND</b> The initial / start temperature (of the acid) <b>AND</b> The final / end temperature (reached by the acid)		<b>1</b>	<b>[1]</b>
<b>(ii)</b>	Insulate (the reaction mixture)  <b>OR</b>  Stir (the mixture while the reaction is taking place)		<b>1</b>	<b>[1]</b>

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Question	Expected Answer	Additional Guidance	Mark	
(iii)	Calculate the heat produced in the reaction using (Q=) mc ΔT  Convert to 1 mol		1  1	[2]
(f)	$3\text{Mg} + 2\text{Al}^{3+} \rightarrow 3\text{Mg}^{2+} + 2\text{Al}$ $(\Delta H_r = ) 3\Delta H_1 - 1\Delta H_2$ Or a suitable Hess' Law cycle   $\Delta H_r/3$		1  1  1	[3]

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<b>Question</b>	<b>Expected Answer</b>	<b>Additional Guidance</b>	<b>Mark</b>	
<b>2 (a)</b>	<b>(i)</b> $\text{Ni}^{2+}(\text{aq}) + 2\text{IO}_3^{-}(\text{aq}) \rightarrow \text{Ni}(\text{IO}_3)_2(\text{s})$		1	[1]
	<b>(ii)</b> 0.1000		1	[1]
	<b>(iii)</b> More precipitate will form		1	[1]
<b>(b)</b>	<b>(i)</b> All points plotted correctly  Straight line drawn through the origin up to at least exp 7.  (If all points do not lie on the line then the net deviation of the non-anomalous points on each side of the best fit line must be approximately the same.)		1  1	[2]
	<b>(ii)</b> Points at 0.0300 mol and 0.0500 mol		1	[1]
<b>(iii)</b>	Loss of precipitate during transfer to filter <b>OR</b> Precipitate not dry <b>OR</b> Not weighing to constant mass <b>OR</b> Precipitate contains ionic materials not removed		1	[1]
<b>(iv)</b>	Point at 0.1000 lies on the extrapolated drawn line of best fit.		1	
	Point at 0.1200 either at the same value as 0.1000 or slightly higher value		1	[2]
<b>(c) (i)</b>	8.174 g		1	[1]

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<b>Question</b>	<b>Expected Answer</b>	<b>Additional Guidance</b>	<b>Mark</b>	
<b>(ii)</b>	0.254 g (from <b>c(i)</b> – 7.92)		1	<b>[3]</b>
	0.000621 (mol)		1	
	$\text{IO}_3^- = 0.00124$ (mol)		1	
<b>(iii)</b>	$[\text{Ni}^{2+}] = 0.306$ <b>AND</b> $[\text{IO}_3^-] = 0.0124$ ECF		1	<b>[2]</b>
	$4.71 \times 10^{-5}$		1	