

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International Advanced Subsidiary and Advanced Level

**MARK SCHEME for the October/November 2014 series****9701 CHEMISTRY****9701/31**

Paper 3 (Advanced Practical Skill 1), maximum raw mark 40

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Page 2	Mark Scheme	Syllabus	Page
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Question	Indicative material	Mark	Total
1 (a)	I Two balance readings and correct mass of magnesium recorded. Table to show temperature and time. Headings and units – must be temperature /°C, (°C), in °C and time/s, (s), or time in seconds or /min, /minutes, ... and /g, (g), ...	1	
	II Thermometer readings to $\pm 0.5^{\circ}\text{C}$ (at least 1 ending in .5 or .0) ( <i>Minimum 8 readings</i> )	1	
	III All specified readings taken <b>and</b> balance readings to the same number of dp	1	
	Difference between temperature at 2 minutes and highest temperature (in table) calculated and compared with $\Delta T$ of Supervisor.		
	IV, V and VI $\Delta T$ within 10% of Supervisor IV and V $\Delta T$ within 15% of Supervisor IV only $\Delta T$ within 20% of Supervisor	3	[6]
(b) (i)	I Axes labelled, linear scales chosen so that more than half the available space is used on both axes for plotted points.	1	
	II Plotted points should be drawn clearly with a sharp pencil. Points should be plotted to within half a small square and in the correct square for y-axis and on line for x-axis.	1	
(ii)	III Correctly extrapolated best fit straight lines drawn up to time $2\frac{1}{2}$ minutes and after $2\frac{1}{2}$ minutes.	1	
(iii)	IV Examiner calculates $\Delta T$ from graph and checks answer is within $0.25^{\circ}\text{C}$ of candidate's stated answer	1	[4]
(c) (i)	All the magnesium/solid dissolved/disappeared <b>or</b> all solid/Mg has gone/been used up <b>or</b> no solid/Mg left	1	
	(ii) Correctly calculates $25 \times 4.2 \times \Delta T$	1	
(iii)	Correctly calculates (ii) $\div$ number of moles of magnesium <b>and</b> converts to $\text{kJ} \left( \frac{\text{(ii)} \times 24.3}{1000 \times \text{mass Mg}} \right)$ <b>and</b> final answer to 2–4 sf	1	
	Sign is negative in (c)(iii) <b>and</b> (e)(iv)	1	[4]
(d)	8 readings (in space below printed area) <ul style="list-style-type: none"> <li>• 4 <math>\times</math> balance readings</li> <li>• 2 <math>\times</math> initial temp</li> <li>• 2 <math>\times</math> highest/max temp</li> </ul> with unambiguous headings	1	
	Correctly calculates both masses of Mg and both $\Delta T$ s.	1	[2]

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Question	Indicative material	Mark	Total
(e) (i) & (ii)	Correctly calculates <ul style="list-style-type: none"> <li>mean <math>\Delta T</math></li> <li>mean mass</li> </ul>	1	
(iii)	Moles $\text{CuSO}_4 = \frac{25 \times 1}{1000} = 0.025$	1	
	Moles Mg = $\frac{\text{(ii) or max mass Mg}}{24.3}$ so $\text{CuSO}_4$ in excess <b>or</b> $<0.025$	1	
(iv)	<b>Working</b> to calculate $\Delta H$ using mean values of mass Mg and $\Delta T$ $\left( \frac{\Delta T(\text{i}) \times 25 \times 4.2 \times 24.3}{(\text{ii}) \times 1000} \right)$ <b>or</b> $\left( \frac{\Delta T(\text{i}) \times 25 \times 4.2}{\text{mol Mg from (iii)} \times 1000} \right)$	1	[4]
(f)	Attempt at use of Hess' law either by cycle or reverse reaction 2	1	
	Correctly calculates $\Delta H$ reaction 3 = $\Delta H$ reaction 1 – $\Delta H$ reaction 2	1	[2]
(g) (i)	<b>Any 2 of</b> Lower $\Delta H$ and so higher % error No correction made for loss of heat on cooling Some bubbles/gas/ $\text{H}_2$ in reaction 2 so wrong reaction taking place Not all Mg reacts/reaction does not go to completion in 2 (so not all energy released) Reaction 2 slower so more heat loss	1 1	
(ii)	No, since (larger volume of solution means) smaller $\Delta T$ OR Yes, since there would be a smaller T rise so less heat would be lost.	1	[3]
<b>Qn 1</b>		<b>Total</b>	<b>[25]</b>

Page 4	Mark Scheme	Syllabus	Page
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Question	Indicative material	Mark	Total
	<b>FA 6</b> is NaNO <sub>3</sub> (s); <b>FA 7</b> is AgNO <sub>3</sub> (aq); <b>FA 8</b> is ZnCO <sub>3</sub> (s)		
<b>2 (a) (i)</b>	Chooses NaOH(aq) (+ heat) (to distinguish NH <sub>4</sub> <sup>+</sup> / ammonium) Chooses named (allow name from <b>(ii)</b> ) dilute acid / (acidified) KMnO <sub>4</sub> (to distinguish between NO <sub>2</sub> <sup>-</sup> / nitrite and NO <sub>3</sub> <sup>-</sup> / nitrate) 2 ions chosen: NH <sub>4</sub> <sup>+</sup> & NO <sub>3</sub> <sup>-</sup> : NaOH (and warm) NO <sub>2</sub> <sup>-</sup> & NO <sub>3</sub> <sup>-</sup> : named (dilute) acid NH <sub>4</sub> <sup>+</sup> & NO <sub>2</sub> <sup>-</sup> : either of the above	1 1	
<b>(ii)</b>	Correct obs with relevant tests With NaOH <b>and</b> warming/heating: no ammonia / no change / no reaction With acid(aq): no brown fumes / no change / no reaction <i>'No observation' is not credited anywhere in the observations.</i>	1 1	
<b>(iii)</b>	<b>FA 6</b> contains NO <sub>3</sub> <sup>-</sup> (with sufficient obs to eliminate other ion(s) given in <b>(i)</b> )	1	[5]
<b>(b)</b>	+ HCl (aq): white ppt  + KI: yellow ppt + NH <sub>3</sub> : no effect / ppt insol  + glucose: silver mirror / black / (dark) grey ppt	1  1 1  1	[4]
<b>(c) (i)</b>	(Solid is) yellow when heated Goes white / paler on cooling	1 1	
<b>(ii)</b>	effervescence / fizzing / rapid bubbling <b>and</b> limewater turns milky	1	
<b>(iii)</b>	White ppt <b>and</b> soluble in excess NaOH	1	
<b>(iv)</b>	White ppt <b>and</b> soluble in excess NH <sub>3</sub>	1	
<b>(v)</b>	Ions present: Zn <sup>2+</sup> <b>and</b> CO <sub>3</sub> <sup>2-</sup> (from fizz <b>or</b> limewater test correct)	1	[6]
<b>Qn 2</b>		<b>Total</b>	<b>[15]</b>