

**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

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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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – October/November 2014	9701	31

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) (Minimum 8 readings)	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) • 4 $\times$ balance readings • 2 $\times$ initial temp • 2 $\times$ highest/max temp 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  Correctly calculates $\Delta H$ reaction 3 = $\Delta H$ reaction 1 – $\Delta H$ reaction 2	1  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]
Qn 1		<b>Total</b>	<b>[25]</b>

Page 4	Mark Scheme	Syllabus	Paper
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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>