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Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the October/November 2014 series

9701 CHEMISTRY

9701/33 Paper 3 (Advanced Practical Skill 1), maximum raw mark 40

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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 ±0.5 °C (at least 1 ending in .5 or .0) (*Minimum 8 readings*)	1	
	III All specified readings taken **and** balance readings to the same number of dp	1	
	Difference between temperature at 2 minutes and highest temperature (in table) calculated and compared with ΔT of Supervisor.		
	IV, **V** and **VI** ΔT within 10% of Supervisor **IV**and **V** ΔT within 15% of Supervisor **IV** only ΔT 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 2½ minutes and after 2½ minutes.	1	
(iii)	**IV** Examiner calculates ΔT from graph and checks answer is within 0.25 °C of candidate's stated answer	1	[4]
(c) (i)	**All** the magnesium / solid dissolved / disappeared **or all** solid / Mg has gone / been used up **or no** solid / Mg left	1	
(ii)	Correctly calculates $25 \times 4.2 \times \Delta T$	1	
(iii)	Correctly calculates **(ii)** ÷ number of moles of magnesium **and** converts to kJ ($\frac{\textbf{(ii)} \times 24.3}{1000 \times \text{mass Mg}}$) **and** final answer to 2–4 sf	1	
	Sign is negative in **(c)(iii) and (e)(iv)**	1	[4]
(d)	8 readings (in space below printed area) • 4 × balance readings • 2 × initial temp • 2 × highest / max temp with unambiguous headings	1	
	Correctly calculates both masses of Mg and both ΔTs.	1	[2]

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Question	Indicative material	Mark	Total
(e) (i) & (ii)	Correctly calculates • mean ΔT • mean mass	1	
(iii)	Moles $CuSO_4$ = $\frac{25 \times 1}{1000}$ = 0.025	1	
	Moles Mg = $\frac{\textbf{(ii)}\ \text{or max mass Mg}}{24.3}$ so $CuSO_4$ in excess **or** <0.025	1	
(iv)	**Working** to calculate ΔH using mean values of mass Mg and ΔT $\left(\frac{\Delta T\textbf{(i)} \times 25 \times 4.2 \times 24.3}{\textbf{(ii)} \times 1000}\right)$ **or** $\left(\frac{\Delta T\textbf{(i)} \times 25 \times 4.2}{\text{mol Mg from } \textbf{(iii)} \times 1000}\right)$	1	[4]
(f)	Attempt at use of Hess' law either by cycle or reverse reaction 2	1	
	Correctly calculates ΔH reaction 3 = ΔH reaction 1 – ΔH reaction 2	1	[2]
(g) (i)	**Any 2 of** Lower ΔH and so higher % error No correction made for loss of heat on cooling Some bubbles / gas / 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 ΔT OR Yes, since there would be a smaller T rise so less heat would be lost.	1	[3]
Qn 1		**Total**	**[25]**

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Question	Indicative material	Mark	Total
	FA 6 is $NaNO_3(s)$; **FA 7** is $AgNO_3(aq)$; **FA 8** is $ZnCO_3(s)$		
2 (a) (i)	Chooses NaOH(aq) (+ heat) (to distinguish NH_4^+ / ammonium) Chooses named (allow name from **(ii)**) dilute acid / (acidified) $KMnO_4$ (to distinguish between NO_2^- / nitrite and NO_3^- / nitrate) 2 ions chosen: NH_4^+ & NO_3^- : NaOH (and warm) NO_2^- & NO_3^- : named (dilute) acid NH_4^+ & NO_2^- : either of the above	1 1	
(ii)	Correct obs with relevant tests With NaOH **and** warming / heating: no ammonia / no change / no reaction With acid(aq): no brown fumes / no change / no reaction *'No observation' is not credited anywhere in the observations.*	1 1	
(iii)	**FA 6** contains NO_3^- (*with sufficient obs to eliminate other ion(s) given in **(i)***)	1	[5]
(b)	+ HC*l* (aq): white ppt	1	
	+ KI: yellow ppt + NH_3: no effect / ppt insol	1 1	
	+ glucose: silver mirror / black / (dark) grey ppt	1	[4]
(c) (i)	(Solid is) yellow when heated Goes white / paler on cooling	1 1	
(ii)	effervescence / fizzing / rapid bubbling **and** limewater turns milky	1	
(iii)	White ppt **and** soluble in excess NaOH	1	
(iv)	White ppt **and** soluble in excess NH_3	1	
(v)	Ions present: Zn^{2+} **and** CO_3^{2-} (from fizz **or** limewater test correct)	1	[6]
Qn 2		**Total**	**[15]**

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