CAMBRIDGE INTERNATIONAL EXAMINATIONS

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

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	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), ... **II** Thermometer readings to ±0.5 °C (at least 1 ending in .5 or .0) (*Minimum 8 readings*) **III** All specified readings taken **and** balance readings to the same number of dp	1 1 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. **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 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 Sign is negative in **(c)(iii) and (e)(iv)**	1 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]

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 Moles Mg = $\frac{\textbf{(ii)}\ \text{or max mass Mg}}{24.3}$ so $CuSO_4$ in excess **or** <0.025	1 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 Correctly calculates ΔH reaction 3 = ΔH reaction 1 – ΔH reaction 2	1 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]**

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 + KI: yellow ppt + NH_3: no effect / ppt insol + glucose: silver mirror / black / (dark) grey ppt	1 1 1 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]**