Cambridge International AS & A Level

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CHEMISTRY **9701/36**

Paper 3 Advanced Practical Skills 2 **October/November 2016**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)	Three masses and all temperatures recorded in a table with unambiguous headings (*no need to include the word mass but do not allow weight, allow t for time*) **and** correctly displayed units: / g, (g), in g (allow time in mins or minutes). Temperatures recorded to 0.5 °C. Examiner checks Supervisor's and candidate's subtraction for mass of **FB 2**. Examiner calculates Supervisor value of ΔT / m to 1 dp and records it at the top of the accuracy grid. ($\Delta T = T_{max} - T$ at 2 minutes) Examiner calculates candidate value of ΔT / m to 1 dp and difference from Supervisor.	1 1

Supervisor ratio	<10	10–20	20>
Award **III** if difference is	±2.0	±3.0	±4.0
Award **IV** if difference is	±1.0	±2.0	±3.0

	Award **III** and **IV** according to above table	1 1 **4**

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Question	Answer	Marks
1(b)	**I** Axes clearly labelled (headings or units) and *T* on *y*-axis. Uniform scale to use more than half of each axis including 3 °C above the highest recorded temperature. **II** All points plotted to within half a small square and within the correct small square. *(Any point that is supposed to be on a line must be on the line and any point that is supposed to be within a small square must not be on a boundary line.* *Do not allow large dots unless the centre of the dot is correctly positioned).* **III** Appropriate lines of best fit drawn. **AND** either a straight line / smooth curve after the max *T* **OR** a smooth curve from 3 minutes. **IV** Lines extrapolated and correct value (within 0.2 °C) of ΔT from graph	1 1 1 1 **4**
1(c)(i)	Correctly calculates energy change = $25 \times 4.2 \times \Delta T$ from **(b)** or correctly calculated ΔT from table	1
1(c)(ii)	Correctly uses value of energy change $\Delta H = \dfrac{\textbf{(c)(i)} \times 65.4}{\text{correct mass from } \textbf{(a)} \times 1000}$ Negative sign and both answers recorded to 2–4 sf	1 1 **3**
1(d)	Correctly uses = $\dfrac{\textbf{(c)(ii)} \times 100}{217}$	1 **1**

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1(e) effect	1(e) reason
maximum *T* would be to RHS / **gradient** (to max *T*) less steep / longer time to the **maximum *T***	surface area less (so reaction slower)
max *T* remains same	as number of amount / moles (of zinc) is the same
max *T* is smaller as reaction takes longer / is slower / surface area is less	greater heat loss

Question	Answer	Marks
1(e)	stated effect reason (*reason must follow effect)*	1 1 **2**
	Total	**14**

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Question	Answer	Marks
2(a)	Mass of solid used between 2.20 and 2.40 g Table with correct headings / units • mass of crucible • mass of crucible + **FB 3** • mass of crucible + residue / **FB 3** after heating Units: / g, (g), in g, in gram(me)s Award **III** if % mass loss is ⩾ 30 but ⩽ 42 Award **III** and **IV** if % mass loss is ⩾ 33 but ⩽ 39	1 1 1 1 **4**
2(b)(i) and (ii)	Correctly calculates mass of anhydrous salt **AND** mass of water lost.	1
2(b)(iii)	Shows expression: $\frac{\text{mass water}}{18} \div \frac{\text{mass anhydrous}}{159.6}$ Correctly calculates, including showing working, value of **x** from **(iii)** and gives as integer	1 1
2(b)(iv)	Equation completed with **x** from **(iii)** and state symbols	1 **4**
2(c)(i)	(Solid) turns blue **and** steam / water vapour given off / temperature rises / heat released / hissing / sizzling (owtte)	1
2(c)(ii)	Anhydrous salt returns to hydrated or original formula quoted Reaction is exothermic	1 1 **3**

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Question	Answer	Marks
2(d)	Value less than accepted value: not all water removed **and** heat to constant mass Value more than accepted value: (anhydrous) salt decomposes **and** practical method of limiting temperature / heat very gently / thermostatically controlled oven	1 1 **2**
	Total:	**13**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td colspan="3">FB 4 is HCOOH(aq); FB 5 is HCl(aq); FB 6 is $NH_4C\mathit{l}$ and $ZnSO_4$(s)</td></tr>
<tr><td>3(a)(i)</td><td>
<table>
<tr><th>FB 4</th><th>FB 5</th></tr>
<tr><td>Fizz</td><td>Fizz</td></tr>
<tr><td>Gas turns limewater cloudy white / milky / chalky / white ppt. OR</td><td>Gas turns limewater cloudy white / milky / chalky/ white ppt.</td></tr>
<tr><td>(Purple) to / goes colourless / paler</td><td>No reaction / stays / turns purple</td></tr>
<tr><td>Silver / grey / AND black ppt / mirror</td><td>No reaction / white ppt</td></tr>
</table>
</td><td>1
1
1
1</td></tr>
<tr><td>3(a)(ii)</td><td>hydrogen (ion) / H^+</td><td>1</td></tr>
<tr><td>3(a)(iii)</td><td>it can be oxidised / contains –CHO group / methanoate ion / $HCOO^-$ / is a reducing agent</td><td>1</td></tr>
<tr><td>3(a)(iv) and 3(a)(v)</td><td>FB 4 is a weaker acid than FB 5 / FB 4 is less dissociated than FB 5
(ecf on reverse ΔTs)

Energy is needed to break (O to H) bond so less is released</td><td>1

1
8</td></tr>
</table>

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Question	Answer	Marks
3(b)	Use of NaOH(aq) **AND** NH_3(aq) (as test for metal ions) **AND** using solution of **FB 6** / **using FB 6** (aq) Use of NaOH(aq) and with excess and result: white ppt soluble in excess Use of NH_3(aq) and with excess and result: white ppt soluble in excess With NaOH(aq) and heat and gas / NH_3 that turns litmus blue Cations are zinc / Zn^{2+} and ammonium / NH_4^+	1 1 1 1 1 **5**
	Total:	**13**

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