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**CHEMISTRY**

**9701/36**

Paper 3 Advanced Practical Skills 2

**October/November 2016**

MARK SCHEME

Maximum Mark: 40

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**Published**

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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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(a)	Three masses and all temperatures recorded in a table with unambiguous headings ( <i>no need to include the word mass but do not allow weight, allow t for time</i> ) <b>and</b> 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 <b>FB2</b> . Examiner calculates Supervisor value of $\Delta T/m$ 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 $\Delta T/m$ to 1 dp and difference from Supervisor.	1           1

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

	Award <b>III</b> and <b>IV</b> according to above table	1 1 <b>4</b>
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Question	Answer	Marks
1(b)	<p><b>I</b> Axes clearly labelled (headings or units) and <math>T</math> on <math>y</math>-axis. Uniform scale to use more than half of each axis including <math>3^{\circ}\text{C}</math> above the highest recorded temperature.</p> <p><b>II</b> All points plotted to within half a small square and within the correct small square. <i>(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).</i></p> <p><b>III</b> Appropriate lines of best fit drawn.</p> <p><b>AND</b> either a straight line/smooth curve after the max <math>T</math> <b>OR</b> a smooth curve from 3 minutes.</p> <p><b>IV</b> Lines extrapolated and correct value (within <math>0.2^{\circ}\text{C}</math>) of <math>\Delta T</math> from graph</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p><b>4</b></p>
1(c)(i)	Correctly calculates energy change = $25 \times 4.2 \times \Delta T$ from <b>(b)</b> or correctly calculated $\Delta T$ from table	1
1(c)(ii)	<p>Correctly uses value of energy change</p> $\Delta H = \frac{\text{(c)(i)} \times 65.4}{\text{correct mass from (a)} \times 1000}$ <p>Negative sign and both answers recorded to 2–4 sf</p>	<p>1</p> <p>1</p> <p><b>3</b></p>
1(d)	Correctly uses = $\frac{\text{(c)(ii)} \times 100}{217}$	1
		<b>1</b>

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1(e) effect	1(e) reason
<b>maximum <math>T</math></b> would be to RHS/ <b>gradient</b> (to max $T$ ) less steep/longer time to the <b>maximum <math>T</math></b>	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

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(e)	stated effect reason ( <i>reason must follow effect</i> )	1 1 <b>2</b>
	<b>Total</b>	<b>14</b>

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Question	Answer	Marks
2(a)	<p>Mass of solid used between 2.20 and 2.40 g</p> <p>Table with correct headings / units</p> <ul style="list-style-type: none"> <li>• mass of crucible</li> <li>• mass of crucible + <b>FB 3</b></li> <li>• mass of crucible + residue / <b>FB 3</b> after heating</li> </ul> <p>Units: /g, (g), in g, in gram(me)s</p> <p>Award <b>III</b> if % mass loss is <math>\geq 30</math> but <math>\leq 42</math></p> <p>Award <b>III</b> and <b>IV</b> if % mass loss is <math>\geq 33</math> but <math>\leq 39</math></p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p><b>4</b></p>
2(b)(i) and (ii)	Correctly calculates mass of anhydrous salt <b>AND</b> mass of water lost.	1
2(b)(iii)	Shows expression: $\frac{\text{mass water}}{18} \div \frac{\text{mass anhydrous}}{159.6}$	1
	Correctly calculates, including showing working, value of <b>x</b> from (iii) and gives as integer	1
2(b)(iv)	Equation completed with <b>x</b> from (iii) and state symbols	1
		<b>4</b>
2(c)(i)	(Solid) turns blue <b>and</b> 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
		<b>3</b>

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

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Question	Answer	Marks	
<b>FB 4</b> is HCOOH(aq); <b>FB 5</b> is HCl(aq); <b>FB 6</b> is NH <sub>4</sub> Cl and ZnSO <sub>4</sub> (s)			
3(a)(i)	<b>FB 4</b>	<b>FB 5</b>	1  1  1  1
	Fizz	Fizz	
	Gas turns limewater cloudy <b>white</b> / milky / chalky / white ppt. <b>OR</b>	Gas turns limewater cloudy <b>white</b> / milky / chalky / white ppt.	
	(Purple) to / goes colourless / paler	No reaction / stays / turns purple	
	Silver / grey / <b>AND</b> black ppt / mirror	No reaction / white ppt	
3(a)(ii)	hydrogen (ion)/H <sup>+</sup>	1	
3(a)(iii)	it can be oxidised / contains –CHO group / methanoate ion / HCOO <sup>-</sup> / is a reducing agent	1	
3(a)(iv) and 3(a)(v)	<b>FB 4</b> is a weaker acid than <b>FB 5</b> / <b>FB 4</b> is less dissociated than <b>FB 5</b> (ecf on reverse ΔTs)	1	
	Energy is needed to break (O to H) bond so less is released	1	
		<b>8</b>	

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(b)	Use of NaOH(aq) <b>AND</b> NH <sub>3</sub> (aq) (as test for metal ions) <b>AND</b> using solution of <b>FB 6</b> / <b>using FB 6</b> (aq)	1
	Use of NaOH(aq) and with excess and result: white ppt soluble in excess	1
	Use of NH <sub>3</sub> (aq) and with excess and result: white ppt soluble in excess	1
	With NaOH(aq) and heat and gas / NH <sub>3</sub> that turns litmus blue	1
	Cations are zinc / Zn <sup>2+</sup> and ammonium / NH <sub>4</sub> <sup>+</sup>	1
		<b>5</b>
		<b>Total: 13</b>