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**CHEMISTRY**

**9701/53**

Paper 5 Planning, Analysis and Evaluation

**May/June 2017**

MARK SCHEME

Maximum Mark: 30

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**Published**

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Question	Answer	Marks
1(a)	diagram of a labelled insulated container containing a liquid	1
	labelled timing device and a labelled thermometer in / touching the liquid	1
1(b)	to ensure temperature of water / experiment / apparatus is at room temperature / constant temperature	1
1(c)	the (anhydrous) calcium chloride is added at this point	1
1(d)	not all the $\text{CaCl}_2$ has dissolved (in the first minute) OR dissolving / reaction was not complete	1
1(e)	the cooling curve has a straight line of best fit that extrapolates to 3.0 minutes (or beyond) AND a straight line connecting all the points from 0–2.5 minutes that extrapolates to 3.0 minutes (or beyond)	1
	theoretical temperature rise <b>to 1dp</b>	1
1(f)	<b>8.5 min</b>  AND not enough time to reach solution temperature OR it takes time for the thermometer to reach equilibrium with the water temperature	1
1(g)	ensure uniformity of heating (of solution)	1
1(h)	wear gloves OR wear (face) mask	1

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Question	Answer	Marks
1(i)	$75.0 \times 4.18 \times 30.0 = 9405 \text{ (J) OR } 9.405 \text{ kJ}$	1
	(1 mol of $\text{CaCl}_2 = 111.1 \text{ g}$ )	1
	Mass $\text{CaCl}_2$ required = $\frac{9.405}{82.5} \times 111.1 = 12.7 \text{ g}$	
	<b>Total:</b>	<b>12</b>

Question	Answer	Marks
2(a)(i)	points plotted correctly from table	1
	line through origin	1
2(a)(ii)	point at $0.045 \text{ g cm}^{-3}$	1
2(a)(iii)	two sets of coordinates shown.	1
	gradient correctly calculated expected value = $66\text{--}67(^{\circ})$ value must be to <b>2 dp</b>	1
2(b)(i)	$0.0750 \times 250 = \mathbf{18.75} \text{ (g)}$	1
2(b)(ii)	dissolve the sucrose / mass of sucrose given in <b>2(b)(i)</b> / weighed mass in a stated volume of (distilled) water, less than $250 \text{ cm}^3$ , or if not stated but then later made up to $250 \text{ cm}^3$ / up to the mark	1
	transfer solution to (a $250 \text{ cm}^3$ ) volumetric flask AND Make up the solution to the mark / flask volume with (distilled) water	1

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Question	Answer	Marks
2(c)(i)	$\left( \frac{0.0350}{0.0750} \times 15.00 = 7.00 \text{ cm}^3 \right)$ Volume of standard solution = <b>7.00</b> (cm <sup>3</sup> ) Volume of distilled water = <b>8.00</b> (cm <sup>3</sup> )	<b>1</b>
2(c)(ii)	burette / graduated pipette	<b>1</b>
2(c)(iii)	solution was more dilute than expected	<b>1</b>
2(d)	3.75 correctly read off graph (0.056–0.057)(g cm <sup>-3</sup> ) or correctly calculated from 3.75 = <b>2(a)(iii)</b> × concentration	<b>1</b>
	conc of sucrose = (56–57)(g dm <sup>-3</sup> ) or multiplying a concentration by 1000 correctly	<b>1</b>
	conc of sucrose = (0.164–0.167)(mol dm <sup>-3</sup> ) or dividing a concentration by M <sub>r</sub> / (342) correctly	<b>1</b>
2(e)	wash out with small volume of solution of concentration to be used	<b>1</b>
2(f)	predicted value: (+)10.10 / 10.1 or twice value at 0.075 taken from graph	<b>1</b>
	explanation: (The plane polarised light encounters) more (twice) molecules / moles / amount of sucrose	<b>1</b>
2(g)	To calibrate the instrument / to set the polarimeter to 0 degrees	<b>1</b>
	<b>Total:</b>	<b>18</b>