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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**

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

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| Question | Answer   | Marks     |
|----------|--|-----------|
| 1(i)     | $75.0 \times 4.18 \times 30.0 = 9405 \text{ (J) OR } 9.405 \text{ kJ}$             | <b>1</b>  |
|          | (1 mol of $\text{CaCl}_2 = 111.1 \text{ g}$ )                                      | <b>1</b>  |
|          | 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  | <b>1</b> |
|           | line through origin  | <b>1</b> |
| 2(a)(ii)  | point at $0.045 \text{ g cm}^{-3}$   | <b>1</b> |
| 2(a)(iii) | two sets of coordinates shown.   | <b>1</b> |
|           | gradient correctly calculated<br>expected value = $66\text{--}67(^{\circ})$  | <b>1</b> |
|           | value must be to <b>2 dp</b>   |          |
| 2(b)(i)   | $0.0750 \times 250 = \mathbf{18.75} \text{ (g)}$   | <b>1</b> |
| 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 | <b>1</b> |
|           | transfer solution to (a $250 \text{ cm}^3$ ) volumetric flask<br>AND<br>Make up the solution to the mark / flask volume with (distilled) water   | <b>1</b> |

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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> )<br>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> |