

CHEMISTRY

9701/51

Paper 5 Planning, Analysis and Evaluation

May/June 2017

MARK SCHEME

Maximum Mark: 30

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 | 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 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 to 1dp | 1 |
| 1(f) | 8.5 min 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) | $75.0 \times 4.18 \times 30.0 = 9405$ (J) OR 9.405 kJ | 1 |
| | (1 mol of $\text{CaCl}_2 = 111.1$ g) | 1 |
| | Mass CaCl_2 required = $\frac{9.405}{82.5} \times 111.1 = 12.7$ g | |
| | Total: | 12 |

| Question | Answer | Marks |
|-----------|--|-------|
| 2(a)(i) | points plotted correctly from table | 1 |
| | line through origin | 1 |
| 2(a)(ii) | point at 0.045 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 2 dp | 1 |
| 2(b)(i) | $0.0750 \times 250 = \mathbf{18.75}$ (g) | 1 |
| 2(b)(ii) | dissolve the sucrose / mass of sucrose given in 2(b)(i) / weighed mass in a stated volume of (distilled) water, less than 250 cm^3 , or if not stated but then later made up to 250 cm^3 / up to the mark | 1 |
| | transfer solution to (a 250 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 = 7.00 (cm ³) Volume of distilled water = 8.00 (cm ³) | 1 |
| 2(c)(ii) | burette / graduated pipette | 1 |
| 2(c)(iii) | solution was more dilute than expected | 1 |
| 2(d) | 3.75 correctly read off graph (0.056–0.057)(g cm ⁻³) or correctly calculated from 3.75 = 2(a)(iii) × concentration | 1 |
| | conc of sucrose = (56–57)(g dm ⁻³) or multiplying a concentration by 1000 correctly | 1 |
| | conc of sucrose = (0.164–0.167)(mol dm ⁻³) or dividing a concentration by M _r / (342) correctly | 1 |
| 2(e) | wash out with small volume of solution of concentration to be used | 1 |
| 2(f) | predicted value: (+)10.10 / 10.1 or twice value at 0.075 taken from graph | 1 |
| | explanation: (The plane polarised light encounters) more (twice) molecules / moles / amount of sucrose | 1 |
| 2(g) | To calibrate the instrument / to set the polarimeter to 0 degrees | 1 |
| | Total: | 18 |