

MARK SCHEME for the May/June 2013 series

9701 CHEMISTRY

9701/35

Paper 3 (Advanced Practical Skills 1), maximum raw mark 40

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.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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| Question | Sections | Indicative material | Mark | Total |
|----------|-----------------------|---|--------|-------|
| 1 (a) | MMO Collection | I All thermometer readings recorded and two weighings + correct mass of FA 1 recorded. | 1 | |
| | PDO Recording | II Correct headings and units in both tables in (a) (Mass) and (c) (Mass and temperature). <i>Must use solidus, brackets or describe unit fully in words. If units not included in column headings every entry must have the correct unit shown.</i> | 1 | |
| | | III Temperature recorded to 0.5°C (<i>must have at least one at 0.5°C and one to 0.0 °C</i>) and weighings to same number of dp (on page 2). Examiner to calculate Supervisor – candidate $\Delta T/m$ (ΔT from table). | 1 | |
| | MMO Quality | Award IV and V if $\delta \leq 0.20\text{ °C g}^{-1}$ Award IV if $0.20 < \delta \leq 0.50\text{ °C g}^{-1}$ | 1 1 | [5] |
| (b) | PDO Layout | I Uniform scales chosen to use more than half of each axis. Axes labelled, ignore units. | 1 | |
| | | II All points correctly plotted within $\frac{1}{2}$ small square and in correct small square on y-axis and on the line on x-axis. | 1 | |
| | | III Appropriate lines of best fit are drawn. | 1 | |
| | ACE Interpretation | IV Correct value of ΔT (or to nearest 0.5°C) from extrapolated lines (ignore sf). | 1 | |
| (c) | PDO Recording | I Table drawn to include weighings, correct mass of FA 2 , initial and final thermometer readings. Examiner to calculate Supervisor – candidate ΔT | 1 | |
| | MMO Quality | Award II and III if $\delta \leq 0.5\text{ °C}$ Award II only if $0.5 < \delta \leq 1.0\text{ °C}$ | 1 1 | |

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| (d) (i) & (iii) | ACE Interpretation | I Correctly calculates $25 \times 4.3 \times \Delta T$ for step 1 and for step 2. | 1 | |
| | (ii) | II Correctly calculates $\frac{\text{answer to (i)} \times 120.4}{\text{mass FA 1} \times 1000}$ (if number of moles calculated, value used must be to at least 2 sf). | 1 | |
| | (iv) | III Correctly calculates $\frac{\text{answer to (iii)} \times 246.4}{\text{mass FA 2} \times 1000}$ (do not penalise incorrect sign a second time). | 1 | |
| | (v) | IV Correctly calculates ΔH from answers to (ii) and (iv) with correct sign ((ii) – (iv)) (allow ecf for sign) | 1 | |
| | PDO Display | V Working in the right direction shown in parts (i) – (iv). (i) and (iii) use of $mc\Delta T$; (ii) use of 120.4; (iv) use of 246.4 | 1 | [6] |
| | | VI All final answers given to 3 or 4 sf (minimum of 3 answers). | 1 | |
| 1 (e) | (i) ACE Interpretation | Single thermometer reading $\pm 0.5^\circ\text{C}$ (or $\pm 0.1^\circ\text{C}$ if candidate recorded T to 0.1°C). $\Delta T \pm 1.0^\circ\text{C}$ (or $\pm 0.2^\circ\text{C}$) | 1 | [2] |
| | (ii) | Calculates $\{1.0/\Delta T\} \times 100$ (or $\{0.2/\Delta T\} \times 100$) for step 2 to 2 or more sf. Allow ecf. | 1 | |
| (f) | (i) ACE Improvements | Student incorrect as smaller temp change or % error in temp change increased. | 1 | [1] |
| | (ii) MMO Interpretation | Calculates $\Delta T/m$ or $m/\Delta T$ or Q/m for each result. Allow mass of solid $\times c \times \Delta T$. | 1 | [2] |
| | MMO Decisions | Yes, values concordant/consistent (shown:– $\Delta T/m$: 1.2/1.20/1.198 and 1.2/1.20/1.196 or $m/\Delta T$: 0.84/0.835 and 0.84/0.836 or Q/m : 128.7 and 128.6 respectively). | 1 | |
| [Total: 23] | | | | |

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| FA 3 is CrCl_3 ; FA 4 is $(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2$; FA 5 is $\text{Pb}(\text{NO}_3)_2$ | | | | | |
|--|--|--|--|-----|-----|
| 2 | (a) | MMO Collection | FA 3 gives grey-green ppt soluble in NaOH/ giving dark green solution in excess and grey-green ppt insoluble in excess NH_3 | 1 | [3] |
| | | | FA 4 gives green/dirty green ppt insoluble in excess of both and turning brown/darkening in at least one | 1 | |
| | | | FA 5 gives white ppt soluble in excess NaOH and white ppt insoluble in excess NH_3 or Award 1 mark if all NaOH observations, including in excess, are correct. Award 1 mark if all NH_3 observations, including in excess, are correct. | 1 | |
| (b) | MMO Decisions | Selects products with excess NaOH in (i) and warms the product in (ii). | 1 | [4] | |
| | | Tests gas /ammonia with (damp) red litmus and turns blue in (ii). (Stand-alone mark irrespective of reagent chosen.) | 1 | | |
| (c) | MMO Decisions | FA 4 gives (gas) turning red litmus blue Neither of the others give a positive result. | 1 1 | [5] | |
| | | I Selects any 2 from: AgNO_3 , BaCl_2 or $\text{Ba}(\text{NO}_3)_2$, $\text{Pb}(\text{NO}_3)_2$ (full reagent names or formulae needed) | 1 | | |
| | | II NaOH + Al and warm do not penalise $\text{OH}^- + \text{Al}$ and warm if full names not given above | 1 | | |
| | | III and IV Any 2 of: only FA 3 gives (white) ppt with Ag^+ ; only FA 4 gives white ppt with Ba^{2+} (allow off-white); FA 3 and FA 4 give white ppt with Pb^{2+} | 1 | | |
| MMO Collection | V FA 5 and FA 4 (if tested) form gas/ammonia on warming (or warm in reagent column) which turns (damp) red litmus paper blue | 1 | | | |

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|--------------------|--------------------|--|---|-----|
| (d) | ACE Conclusions | I FA 3 contains Cr^{3+} and Cl^- | 1 | |
| | | II FA 4 contains Fe^{2+} and SO_4^{2-} | 1 | |
| | | III Only FA 4 contains NH_4^+ | 1 | |
| | | IV FA 5 contains either Pb^{2+} or Al^{3+} (both given) | 1 | |
| | | V Only FA 5 contains NO_3^- | 1 | [5] |
| [Total: 17] | | | | |