

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

**MARK SCHEME for the October/November 2011 question paper
for the guidance of teachers**

9701 CHEMISTRY

9701/34

Paper 3 (Advanced Practical Skills 2),
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 must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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| Question | Sections | Indicative material | Mark | |
|----------|--|---|------|-----|
| 1 (a) | MMO Collection | I Performs experiment and records all sensible thermometer readings. | 1 | [8] |
| | PDO Collection | II Records all thermometer readings to 0.0/0.5 °C. | 1 | |
| | ACE Interpretation | III Correctly calculates the temperature rises. | 1 | |
| | MMO Quality | Award IV , V and VI for a ΔT within 0.5 °C of Supervisor's result. Award IV and V for a ΔT within 1.0 °C of Supervisor's result. Award IV only for a ΔT within 1.5 °C of Supervisor's result. | 3 | |
| | Calculate result for 35 cm ³ by multiplying candidate's result for 30 cm ³ of FB 1 by 0.75, round up to the nearest 0.5 °C. | | | |
| | | Award VII and VIII if candidate's temperature rise for 35 cm ³ FB 1 is within 0.5 °C of calculated value. Award VII only if ΔT is within 1.0 °C | 2 | |
| (b) | PDO Display | I Axes labelled: temperature/T change or ΔT and volume/Vol/V sodium hydroxide/NaOH and correct units /°C or (°C) or 'in °C', /cm ³ or (cm ³). | 1 | [4] |
| | | II Suitable scales chosen so that the points, if plotted, would occupy at least half the available length for x- and y-axes. <i>Do not award if 50 cm³ not included.</i> | 1 | |
| | | III Plotting – accurate to within half a small square and in the correct square. | 1 | |
| | | IV Draws two straight lines of best fit which intersect. <i>Allow coming to a point (not curved). Does not have to go through (0,0).</i> | 1 | |

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|--------------------|--------------------|--|--------|-----|
| (c) | ACE Interpretation | (i) I Reads to nearest $\frac{1}{2}$ square temperature rise to 1 dp at point of intersection. Do not award if intersection < largest ΔT . | 1 | [7] |
| | | (ii) II Reads to nearest $\frac{1}{2}$ square volume of FB 1 to 1 dp or nearest 0.5 cm^3 at point of intersection. | 1 | |
| | | (iii) III Correctly calculates moles of sodium hydroxide [volume of FB 1 in (ii) $\times 1.5/1000$] to 2 to 4 sf. | 1 | |
| | | (iv) IV Heat energy produced = $50 \times 4.3 \times$ temperature rise from (i) | 1 | |
| | | V Correct answer calculated to 3 or 4 sf. <i>ecf from incorrect volume</i> | 1 | |
| | | (v) VI $\frac{\text{candidate's answer to (iv)}}{\text{candidate's answer to (iii)}}$ | 1 1 | |
| | | VII Negative sign and answer in kJ to 2 to 4 sf | 1 | |
| (d) | ACE Interpretation | Identifies a source of error e.g. precision of thermometer, precision of measuring cylinder* | 1 | [2] |
| | ACE Improvements | Suggests thermometer with smaller scale divisions (0.1°C), use of burette* | 1 | |
| (e) | ACE Interpretation | (i) I Calculates or expression for the volume of FB 2 which reacts [50 – (c)(ii)]. | 1 | [4] |
| | | II Correctly calculates the concentration of H^+ in mol dm^{-3} (≥ 2 sf) [(c)(iii) $\times 1000/\{50 - (c)(ii)\}$]. | 1 | |
| | PDO Display | (ii) III Divides the answer from (i) by 2 | 1 | |
| | Decisions | (iii) IV Describes test and result for sulfate ion. White ppt with (aq) barium chloride or nitrate | 1 | |
| [Total: 25] | | | | |

| | | |
|--------|---|------------------------------------|
| * e.g. | 1 st mark | 2 nd mark |
| | use more sensitive thermometer | 0.5, 0.2, 0.1°C or smaller % error |
| | smaller divisions in measuring cylinder | burette or decrease % error |
| | use burette as more accurate | |
| | cup has little water, use dry cup | |
| | 10 cm ³ too small to take T, start with 20 cm ³ | |

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|--------------|---|---|---|--|
| | FB 3 is Na ₂ CO ₃ (aq); FB 4 is Na ₂ CrO ₄ (aq); FB 5 is NaBr; FB 6 is MnO ₂ | | | |
| 2 (a) | PDO Recording MMO Collection | (i) I All observations in a single table (2 × 3) No repeat of headings & ≥ 4 boxes filled. Observations for both tests on each solution are correct. | 1 | |
| | | II FB 3 | 1 | |
| | | III FB 4 | 1 | |
| | | IV FB 5 | 1 | |

| Solution | H ₂ SO ₄ | Pb(NO ₃) ₂ |
|-------------|---|-----------------------------------|
| FB 3 | bubbling/effervescence and CO ₂ identified by test (allow gas turns limewater milky) | white ppt |
| FB 4 | turns orange/orange (solution) forms (not ppt but not CON for identity) | yellow ppt |
| FB 5 | no change/no reaction [not “ – “] | white ppt |

| | | | | |
|------------|--------------------------------|---|---|--------------------|
| | ACE Conclusions | V FB 3 carbonate/CO ₃ ²⁻ from effervescence or positive limewater test | 1 | |
| | | VI FB 4 chromate(VI)/chromate/CrO ₄ ²⁻ from either observation but no CON obs | 1 | [6] |
| | MMO Decisions Collection | (ii) I Addition of (aq) silver nitrate to FB 5. ecf on obs in table if no ppt with FB 5 + Pb²⁺ | 1 | |
| | | II Cream ppt (white ppt loses II and III) If NH ₃ used obs must be correct. | 1 | |
| | ACE Conclusions | III FB 5 bromide/Br from cream ppt (or off-white ppt insol or partially soluble in NH ₃) | 1 | [3] |
| (b) | MMO Collection | (i) I (bubbling/effervescence and) gas rekindles glowing splint | 1 | |
| | | (ii) II filtrate is yellow/qualified yellow/yellowish green/light brown and produces a red-brown/brown/rust/black (not red) ppt with aqueous sodium hydroxide | 1 | |
| | | (iii) III filtrate is green/qualified green | 1 | |
| | ACE Conclusions | IV filtrate turns purple/pink (with acid) | 1 | |
| | | V (i) FB 6 is a catalyst <i>Allow O₂ formed or H₂O₂ decomposes if glowing splint test correct.</i> | 1 | |
| | | VI (ii) FB 6 is an oxidant/oxidising agent/is reduced. | 1 | [6] |
| | | | | [Total: 15] |