

**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**

**9701/33**

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 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.

Cambridge is publishing the mark schemes for the October/November 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.



|        |  |          |       |
|--------|--|----------|-------|
| Page 2 | Mark Scheme: Teachers' version         | Syllabus | Paper |
|        | GCE AS/A LEVEL – October/November 2011 | 9701     | 33    |

| Question   | Sections           | Indicative material   | Mark |     |
|--|--------------------|---|------|-----|
| 1 (a)  | PDO Recording      | <b>I</b> Thermometer readings for all experiments recorded to 0.0 or 0.5°C. (At least one recorded to 0.5°C.)   | 1    | [7] |
|  | ACE Interpretation | <b>II</b> Calculation of all temperature changes correct.   | 1    |     |
|  | MMO Quality        | Award <b>III</b> for a temperature rise followed by constant temperature (within 0.5°C).  | 1    |     |
|  |                    | Award <b>IV</b> and <b>V</b> for a <b>maximum</b> rise within 0.5°C of supervisor.  | 1    |     |
|  |                    | Award <b>IV</b> for a <b>maximum</b> rise within 1.0°C of supervisor.   | 1    |     |
|  |                    | Award <b>VI</b> and <b>VII</b> for the experiment <b>3</b> temperature rise within 0.5°C of supervisor.   | 1    |     |
| Award <b>VI</b> for the experiment <b>3</b> temperature rise within 1.0°C of supervisor. | 1                  |   |      |     |
| (b)  | PDO Layout         | <b>I</b> Axes correct and labelled: temperature change/ T change/ $\Delta T$ and volume/vol/V (of) sodium hydroxide/NaOH/ <b>FA 1</b> and correct units /°C or (°C) or 'in °C'; /cm <sup>3</sup> or (cm <sup>3</sup> ) (allow NaOH in cm <sup>3</sup> )         | 1    | [4] |
|  |                    | <b>II</b> Scales chosen so that graph occupies at least half the available length for x- and y-axes.  | 1    |     |
|  |                    | <b>III</b> Plotting – all points accurate to within half a small square and in the correct square.  | 1    |     |
|  |                    | <b>IV</b> Draws two straight lines of best fit which intersect.   | 1    |     |
| (c)  | ACE Interpretation | Reads to nearest ½ square to 1 or 2 dp volume of <b>FA 1</b> and temperature rise from intercept. Do <b>not</b> award if $\Delta T$ at intercept (or point) < max $\Delta T$ from table unless candidate has clearly indicated the max $\Delta T$ is anomalous. | 1    | [1] |

|        |  |          |       |
|--------|--|----------|-------|
| Page 3 | Mark Scheme: Teachers' version         | Syllabus | Paper |
|        | GCE AS/A LEVEL – October/November 2011 | 9701     | 33    |

|     |  |    |  |                    |     |
|-----|--|----|--|--------------------|-----|
| (d) | ACE<br>Conclusions                       | I  | The temperature/temperature change increases as <b>more</b> reaction/more hydrochloric acid/sodium hydroxide reacts/as more water formed.  | 1                  | [2] |
|     |  | II | The temperature/temperature change stays constant/decreases when all acid/limiting reagent has reacted/excess NaOH is added.   | 1                  |     |
| (e) | ACE<br>Interpretation                    | I  | Volume used in calculation is 65 cm <sup>3</sup>   | 1                  | [2] |
|     |  | II | Heat energy change calculated using candidate's value for $\Delta T$ correct to 3 or 4 sf  | 1                  |     |
| (f) | ACE<br>Interpretation                    |    | $\frac{25 \times 2}{1000} = 0.05$  | 1                  | [1] |
| (g) | ACE<br>Interpretation<br><br>PDO Display | I  | <u>Candidate's answer to (e)</u><br>Candidate's answer to (f)  | 1                  | [2] |
|     |  | II | Correct calculation, conversion J to kJ and negative sign to 3 or 4 sf   | 1                  |     |
| (h) | ACE<br>Conclusions                       |    | So that rise in temperature is proportional to increase in energy produced/change in volume gives different change in temperature for same energy produced/increase in volume requires increase in energy for same temperature rise. | 1                  | [1] |
| (i) | PDO Display                              | I  | Number moles NaOH = number moles HCl (stated or clearly shown)   | 1                  | [2] |
|     | ACE<br>Interpretation                    | II | Calculates or expression for Concentration = $\frac{0.05 \text{ (ecf from (f))}}{\text{answer to (c)}/1000}$<br>If answer only, award mark if correct to 3 or 4 sf   | 1                  |     |
| (j) | ACE<br>Improvements                      |    | Use more <b>concentrated</b> solutions. (allow use $\leq 5 \text{ cm}^3$ water each time)<br>Ignore all references to heat energy losses.  | 1                  | [1] |
| (k) | ACE<br>Conclusions                       | I  | Two straight intersecting lines (positive followed by zero gradient).  | 1                  | [2] |
|     |  | II | Same $\Delta T$ and V shown as in (b).   | 1                  |     |
|     |  |    |  | <b>[Total: 25]</b> |     |

|        |  |          |       |
|--------|--|----------|-------|
| Page 4 | Mark Scheme: Teachers' version         | Syllabus | Paper |
|        | GCE AS/A LEVEL – October/November 2011 | 9701     | 33    |

| FA 3 is Na <sub>2</sub> S <sub>2</sub> O <sub>5</sub> (s); FA 4 is Na <sub>2</sub> CO <sub>3</sub> (s); FA 5 is Na <sub>2</sub> SO <sub>4</sub> (s); FA 6 is Pb(NO <sub>3</sub> ) <sub>2</sub> (s) and (aq) |  |  |   |             |     |
|---|--|--|---|-------------|-----|
| 2   | (a)  | MMO Decisions  | (i) I Any named mineral acid or formula or (acidified) potassium dichromate<br>Do <b>not</b> allow any reagent suitable for testing cations or more than one reagent.   | 1           | [6] |
|   | PDO Recording  | (ii) II Tabulates evidence of 3 tests carried out with no repeat headings.<br><b>Only</b> consider observations with acid or dichromate. | 1   |             |     |
| MMO Collection  | III Bubbles/effervescence in <b>FA 4</b> .   | 1  |   |             |     |
| MMO Decisions   | IV Slower effervescence in <b>FA 3</b> than <b>FA 4</b> or <b>FA 3</b> turns green <b>and</b> <b>FA 5</b> stays orange if dichromate used.                           | 1  |   |             |     |
| ACE Conclusions   | V Appropriate test with positive result used to test for either gas.   | 1  |   |             |     |
|   | VI All three ions correct from suitable observations.<br><b>FA3</b> is a sulfite.<br><b>FA4</b> is a carbonate.<br><b>FA5</b> is a sulfate.<br>(or correct formulae) | 1  |   |             |     |
|   | (b)  | MMO Collection   | (i) I <b>FA 4 + FA 6</b> white ppt <b>and</b> <b>FA 5 + FA 6</b> white ppt.<br>II <b>FA 6 + NaOH</b> white ppt, soluble in excess sodium hydroxide.<br>III Brown gas<br>IV Gas relights glowing splint.<br>V Yellow residue or crackling/decrepitating.<br>VI Gas identified as oxygen or as NO <sub>2</sub> from observations. | 1           | [6] |
|   |  | ACE Conclusions  | (ii) Lead/Pb <sup>2+</sup> provided correct observations with <b>FA 6 + NaOH and FA 6 + FA 5</b> (sulfate).   | 1           |     |
|   |  | ACE Conclusions  | (iii) I Add HCl / H <sub>2</sub> SO <sub>4</sub> / KI / K <sub>2</sub> CrO <sub>4</sub> / NH <sub>3</sub> *   | 1           |     |
|   |  | MMO Decisions  | II white ppt/white ppt/yellow ppt/yellow ppt/white ppt insoluble in excess.   | 1           |     |
|   |  | MMO Collection   | * If not Pb <sup>2+</sup> in (ii) but one of Al <sup>3+</sup> , Ba <sup>2+</sup> , Ca <sup>2+</sup> , Zn <sup>2+</sup> allow suitable reagent mark: K <sub>2</sub> CrO <sub>4</sub> for Ba <sup>2+</sup> and NH <sub>3</sub> for the other three.<br>However, observation must be correct for <b>Pb<sup>2+</sup></b> .          | 1           | [2] |
|   |  |  |   | [Total: 15] |     |