

MARK SCHEME for the May/June 2014 series

9701 CHEMISTRY

9701/31

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 2014 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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|--------|--------------------------------|----------|-------|
| Page 2 | Mark Scheme | Syllabus | Paper |
| | GCE AS/A LEVEL – May/June 2014 | 9701 | 31 |

| Question | Sections | Indicative material | Mark | Total |
|---|------------------|--|------|-------|
| 1 (a) | PDO Layout | I Initial and final readings and titre value given for rough titre and initial and final readings for two (or more) accurate titrations (<i>minimum of 2 × 2 box</i>) | 1 | |
| | PDO Recording | II Appropriate headings and units for all accurate data. and volume FA 1 added recorded for each accurate titre. <i>Headings should match readings.</i> <ul style="list-style-type: none"> initial/start (burette) reading/volume final/end (burette) reading/volume titre or volume/FA 1 used/added (not “difference”) unit: /cm³ or (cm³) or in cm³ or cm³ for each entry | 1 | |
| | MMO Decisions | III All accurate burette readings recorded to 0.05 cm ³ . <i>The need to record to 0.05 applies only to the burette readings and not to the recorded titres.</i> <i>Do not award this mark if:</i> <ul style="list-style-type: none"> 50.(00) is used as an initial burette reading more than one final burette reading is 50.(00) any burette reading is greater than 50.(00). | 1 | |
| <p>Examiner rounds burette readings to the nearest 0.05 cm³, checks subtractions and then selects the ‘best’ titres using the hierarchy: two (or more) identical, then two (or more) within 0.05 cm³, then two (or more) within 0.1 cm³, etc. Examiner compares candidate mean titre with Supervisor mean titre.</p> | | | | |
| (a) | MMO Quality | Award V and VI for difference from Supervisor, $\delta \leq 0.20 \text{ cm}^3$ Award V only for $0.20 < \delta \leq 0.40 \text{ cm}^3$ <i>Spread penalty: if the two ‘best’ titres are $\geq 0.50 \text{ cm}^3$ apart cancel one of the Q marks.</i> | 2 | [6] |

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|--------|--------------------------------|----------|-------|
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| | GCE AS/A LEVEL – May/June 2014 | 9701 | 31 |

| Question | Sections | Indicative material | Mark | Total |
|-------------|--|--|------------------------------|-------------|
| (b) | ACE Interpretation | <p>Candidate must average two (or more) titres that are within 0.20 cm^3. Working must be shown or ticks must be put next to the two (or more) accurate readings selected.</p> <p><i>The mean should normally be quoted to 2 dp rounded to the nearest 0.01.</i></p> <p><i>Two special cases where the mean may not be to 2 dp: allow mean to 3 dp only for 0.025 or 0.075 e.g. 26.325; allow mean to 1 dp if all accurate burette readings were given to 1 dp and the mean is exactly correct. e.g. 26.0 and 26.2 = 26.1 is correct but 26.0 and 26.1 = 26.1 is incorrect.</i></p> <p><i>Note: the candidate's mean will sometimes be marked as correct even if it is different from the mean calculated by the Examiner for the purpose of assessing accuracy.</i></p> | 1 | [1] |
| (c) | ACE Interpretation PDO Display ACE Interpretation PDO Display | <p>I Correctly evaluates $\frac{0.0200 \times (\mathbf{b})}{1000}$ in (i)</p> <p>II Correctly evaluates $\frac{(\mathbf{i}) \times 5/2}{25}$ in (iii)</p> <p>III Correct balanced equation in (iv)</p> <p>IV Correctly evaluates $\text{ans } (\mathbf{iii}) \times \frac{1}{2} \times 24.0$ in (v) (Allow ecf from incorrect equation)</p> <p>V All answers given to 3 or 4 sf (minimum of 3 answers attempted)</p> | 1 1 1 1 | [5] |
| Qn 1 | Total | | | [12] |

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|--------|--------------------------------|----------|-------|
| Page 4 | Mark Scheme | Syllabus | Paper |
| | GCE AS/A LEVEL – May/June 2014 | 9701 | 31 |

| Question | Sections | Indicative material | Mark | Total |
|-------------|-----------------------|--|------|-------------|
| 2 (a) | PDO Recording | <p>I Table to include</p> <ul style="list-style-type: none"> • volume of hydrogen peroxide/FA 2, • volume of potassium iodide/FA 4, • volume of distilled water, • reaction time. <p>volume/V in cm³//cm³/ (cm³), time/t in seconds//s/(s). (Minimum 2 expts recorded)</p> | 1 | [6] |
| | | <p>II All times recorded to the nearest second. (Minimum 2 expts)</p> | 1 | |
| | ACE Interpretation | <p>III Correctly calculates all three rates (allow to 2 or 3 sf)</p> <p>Compare times for Expts 1 and 3 with those of the Supervisor.</p> | 1 | |
| | MMO Quality | <p>Award IV, V and VI for both times within 3 s Award IV and V for one within 3 s and one within 6 s Award IV only for either within 6 s (If only 2 expts carried out IV is available – from either expt performed)</p> | 3 | |
| (b) | ACE Conclusion | Rate increases with increasing concentration of hydrogen peroxide and potassium iodide (ora). Allow ecf from candidate's results. | 1 | [1] |
| (c) | MMO Decisions | <p>Selects different volumes of FA 4 (less than 20 cm³, not 10 cm³ and not closer than 2 cm³ to suggested volumes or to 20 cm³ or to 10 cm³)</p> | 1 | [2] |
| | | <p>Volumes of distilled water selected so that vol of water + vol of FA 4 = 20 cm³ and FA 2 = 20 cm³ If FA 3 and FA 5 are shown then the volumes must be constant.</p> | 1 | |
| (d) | ACE Improvements | <p>Reason: change of temperature Use water bath to maintain constant temperature</p> | 1 | [2] |
| | | <p>Reason: decomposition of hydrogen peroxide Store H₂O₂(aq) in the fridge, make up fresh H₂O₂(aq), check conc. of H₂O₂(aq), keep H₂O₂(aq) in dark/dim light.</p> | 1 | |
| (e) (i) | ACE Interpretation | <p>Expression $\frac{1}{\text{time from Expt 1}} \times 100$ or correct value.</p> | 1 | [2] |
| | | <p>(Higher conc. of thiosulfate means) greater reaction time (allow reaction will be slower) and so a smaller percentage error.</p> | 1 | |
| Qn 2 | Total | | | [13] |

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|--------|--------------------------------|----------|-------|
| Page 5 | Mark Scheme | Syllabus | Paper |
| | GCE AS/A LEVEL – May/June 2014 | 9701 | 31 |

| Question | Sections | Indicative material | Mark | Total | |
|---|--|---|--|-------|---|
| FA 6 is ZnSO ₄ (aq) and NaBr(aq); FA 7 is FeSO ₄ (aq) | | | | | |
| 3 (a) | (i) MMO Decisions PDO Layout MMO Collection ACE Conclusion | I Selects NaOH(aq) and NH ₃ (aq), and uses each in excess | 1 | | |
| | | II Unambiguous layout of all 4 observations (excess must be stated). | 1 | | |
| | | III White ppt with NaOH and soluble in excess. | 1 | | |
| | | IV White ppt with NH ₃ soluble in excess. | 1 | | |
| | | V Zn ²⁺ | 1 | | |
| | (ii) MMO Collection ACE Conclusion | VI Cream ppt with AgNO ₃ and partially sol / insol in NH ₃ | 1 | | |
| | | VII White ppt with BaCl ₂ /Ba(NO ₃) ₂ and insol in nitric acid. | 1 | | |
| | | VIII Br ⁻ | 1 | | |
| | | IX SO ₄ ²⁻ | 1 | | |
| [9] | | | | | |
| (b) | (i) MMO Collection | I Green ppt turning brown (in contact with air) | 1 | | |
| | | (ii) | II No reaction/no change or yellow or green solution | | 1 |
| | | (iii) | III Red-brown/brown/green-brown ppt and effervescence | | 1 |
| | | IV Gas relights a glowing splint | 1 | | |
| | (iv) ACE Conclusion | V Redox | 1 | | |
| (v) | VI Decomposition of hydrogen peroxide to give oxygen or ppt is Fe(OH) ₃ / oxidation of Fe ²⁺ to Fe ³⁺ | 1 | | | |
| [6] | | | | | |
| Qn 3 | Total | | [15] | | |