

MARK SCHEME for the May/June 2014 series

9701 CHEMISTRY

9701/32

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 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 |
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| 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 FB 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/FB 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). IV Has two uncorrected, accurate titres within 0.1 cm ³ . <i>Do not include a reading labelled ‘rough’.</i> <i>Do not award this mark if, having performed two titres within 0.1 cm³, a further titration is performed that is more than 0.1 cm³ from the closer of the two initial titres unless further titrations within 0.1 cm³ of any other have also been carried out.</i> <i>Do not award the mark if any ‘accurate’ burette readings (apart from initial 0) are given to zero dp.</i> | 1 | |
| <p>All burette readings should be rounded to the nearest 0.05 cm³. Subtractions should be checked. The ‘best’ titres should be selected 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 | V, VI and VII Award V, VI and VII for a difference from Supervisor, $\delta \leq 0.20 \text{ cm}^3$ Award V and VI for $0.20 < \delta \leq 0.30 \text{ cm}^3$ Award V only for $0.30 < \delta \leq 0.50 \text{ cm}^3$ <i>Spread penalty: if the two ‘best’ titres are $\geq 0.50 \text{ cm}^3$ apart cancel one of the Q marks.</i> | 3 | [7] |

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|-------------|-----------------------|---|-----------|-------|
| (b) | MMO Decisions | <p>Candidate must average two (or more) titres that are within 0.20 cm³. 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 | <p>I Correctly calculates $\frac{(b) \times 0.100}{1000}$ in (i) and gives ans (i) $\times 40$ in (iii) (both answers to 3 or 4 sf)</p> | 1 | |
| | PDO Display | <p>II Gives correct equation in (ii) $H^+ + HCO_3^- \rightarrow H_2O + CO_2$ (allow H_2CO_3)</p> | 1 | [2] |
| Qn 1 | Total | | 10 | |

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| Question | Sections | Indicative material | Mark | Total |
|-------------|--------------------|--|------|-------------|
| 2 (a) | PDO Display | I Shows clearly mass of empty crucible, mass of crucible + FB 3 , mass of crucible and residue with correct units. (mass/g or (g) or in g) | 1 | [4] |
| | Recording | II Records all weighings consistently to at least 1 dp and records the correctly calculated mass of FB 3 used and water lost. <i>Units must be correct and headings must be unambiguous.</i> | 1 | |
| | MMO Quality | Calculate mass of water lost/mass of FB 3 to 2 dp and compare with Supervisor value. Award III and IV if $\delta \leq 0.05$ Award IV only if $0.05 < \delta \leq 0.08$ | 2 | |
| (b) (i) | ACE Interpretation | I $\frac{\text{mass water lost}}{18}$ (expression) or correct moles of water Final answer must be to 2 to 4 sf | 1 | [5] |
| | | II moles of water divided by 10 or correct answer | 1 | |
| | | III M_r in (ii) from mass/ans (i) | 1 | |
| (ii) | | IV Calculates A_r of M $A_r = \frac{M_r - 240}{2}$ | 1 | |
| (iii) | Conclusion | V Choice of identity of M corresponds to nearest A_r | 1 | |
| (c) | ACE Interpretation | 0.1 or 0.2 for 1 dp balance, 0.01 or 0.02 for 2 dp balance, 0.001 or 0.002 for 3 dp balance in (i) and $\frac{(i) \times 100}{\text{mass of water}}$ in (ii) (expression or correct answer) | 1 | [1] |
| (d) | ACE Improvement | Problem and appropriate improvement required. Not all the water was lost (1) so heat to constant mass (1) Water was regained on cooling (1) so cool in a desiccator/ with a lid (1) Use a balance with more dp (1) this gives a lower percentage error (1) The solid frothed/spat on heating (1) so use a deeper crucible/heat even more gently (1) Small amount of solid used gives high percentage error (1) use more solid. | 2 | [2] |
| Qn 2 | Total | | | [12] |

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| Question | Sections | Indicative material | Mark | Total | |
|---|----------------|--------------------------|--|-------|--|
| FB 4 is MgSO ₄ ; FB 5 is C ₆ H ₁₂ O ₆ (aq) reacts as ethanal; FB 6 is H ₂ O reacts as propanone; FB 7 is C ₂ H ₅ OH; FB 8 is HCOOH(aq) | | | | | |
| 3 | (a) (i) | MMO Decisions | I Selects NaOH and NH ₃ , and uses each in excess. | 1 | |
| | | PDO Layout | II Unambiguous layout of all 4 observations. | 1 | |
| | | MMO Collection | III White ppt with NaOH and insoluble in excess. | 1 | |
| | | ACE Conclusion | IV White ppt with NH ₃ and insoluble in excess. V Mg ²⁺ | 1 | |
| | (ii) | MMO Decisions Collection | VI Selects barium chloride/barium nitrate and hydrochloric/nitric acid. | 1 | |
| | | | VII White ppt. | 1 | |
| | | ACE Conclusion | OR VI selects acidified potassium manganate(VII) VII no reaction/stays purple/purple solution formed | | |
| | | | OR VI add a named acid and test for sulfur dioxide VII negative test VIII SO ₄ ²⁻ | 1 | |
| (b) | (i) | MMO Collection | I FB 5 and Tollens': silver mirror/black or brown or grey ppt | 1 | |
| | | | II FB 7 and manganate(VII): colour change purple to colourless/decolourised | 1 | |
| | | | III No reaction for FB 6 with both reagents and FB 7 with Tollens' | 1 | |
| | (ii) | ACE Conclusion | IV FB 6 is propanone (with no reactions observed) | 1 | |
| | | | V FB 5 and FB 7 identified | 1 | |
| | (iii) | MMO Decisions | VI Selects 2,4-DNPH | 1 | |
| | | ACE Conclusion | VII Red/orange/yellow ppt for FB 5 and FB 6 and no change for FB 7 ecf from identities in (ii) | 1 | |
| | | | | [8] | |
| | | | | [7] | |

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| Question | Sections | Indicative material | Mark | Total |
|-----------------|-------------------|--|-------------|--------------|
| (c) | MMO Collection | Decolourises KMnO_4 Effervescence/fizzing/bubbles Turns limewater milky | 1 1 1 | [3] |
| Qn 3 | Total | | | [18] |