

CHEMISTRY**9701/33**

Paper 3 Advanced Practical Skills 1

October/November 2017

MARK SCHEME

Maximum Mark: 40

Published

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This document consists of **7** printed pages.

| Question | Answer | Marks |
|----------|--|----------|
| 1(a) | <p>I The following data is shown</p> <ul style="list-style-type: none"> • two burette readings for the rough titration • titre for rough titration • initial and final burette readings for two (or more) accurate titrations (<i>i.e.</i> 2×2 “box”) | 1 |
| | <p>II Appropriate headings and units for accurate titration. and volume FA 1 added recorded for each accurate titre. <i>Headings should match readings.</i></p> <ul style="list-style-type: none"> • initial / start and (burette) reading / volume (<i>allow vol but not V</i>) • final / end and (burette) reading / volume • titre or volume / FA 1 and used/added (<i>but not “difference” or “total” or “change”</i>) <p>unit: / cm^3 or (cm^3) or in cm^3 or cm^3 for each entry</p> | 1 |
| | <p>III All accurate burette readings are to the nearest 0.05 cm^3. <i>The requirement to record to 0.05 applies to burette readings, including 0.00 cm^3 (if this was the initial reading), but it does not apply to the titre.</i> <i>Do not award this mark if:</i></p> <ul style="list-style-type: none"> • <i>50(.00) is used as an initial burette reading</i> • <i>more than one final burette reading is 50.(00)</i> • <i>any burette reading is greater than 50.(00)</i> | 1 |
| | <p>IV The final accurate titre recorded is within 0.10 cm^3 of any other accurate titre.</p> | 1 |
| | <p>Examiner rounds any accurate burette readings to the nearest 0.05 cm^3 and then selects the ‘best’ titres using the hierarchy:</p> <ul style="list-style-type: none"> • two (or more) accurate identical titres, then • two (or more) accurate titres within 0.05 cm^3, then • two (or more) accurate titres within 0.10 cm^3 etc. <p>These best titres should be used to calculate the mean corrected titre to the nearest 0.01 cm^3. Examiner compares candidate’s titre value with that of the Supervisor:</p> | |

| Question | Answer | Marks |
|----------|--|-------|
| 1(a) | Award V , VI and VII if $\delta \leq 0.30$ (cm ³) | 1 |
| | Award V and VI if $0.30 < \delta \leq 0.60$ | 1 |
| | Award V , only, if $0.60 < \delta \leq 1.00$ | 1 |
| 1(b) | <p>Candidate calculates the mean correctly.</p> <ul style="list-style-type: none"> • Candidate averages two (or more) titres where the total spread is ≤ 0.20 cm³. • Working must be shown or ticks must be put next to the two (or more) accurate readings selected. • The mean should be quoted to 2 dp, and be rounded to nearest 0.01 cm³. (e.g. 26.666 cm³ must be rounded to 26.67 cm³) <p>Two special cases, where the mean need not be to 2 dp:</p> <ul style="list-style-type: none"> • Allow mean to 3 dp only for 0.025 or 0.075 (e.g. 26.325 cm³) • 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 allowed) (e.g. 26.0 and $26.1 = 26.1$ is wrong – should be 26.05) <p>Do not award this mark if:</p> <ul style="list-style-type: none"> • The rough titre was used to calculate the mean. • The candidate performed only one accurate titration. • Burette readings were incorrectly subtracted to obtain any of the accurate titre values. • All burette readings (resulting in titre values used in calculation of mean) are integers. <p>Note: the candidate's mean will sometimes be marked correct even if it was different from the mean calculated by the Examiner for the purpose of assessing accuracy.</p> | 1 |
| 1(c)(i) | <p>Correctly calculates</p> $\text{Number of moles of } \text{S}_2\text{O}_3^{2-} \text{ used} = 0.150 \times \frac{\mathbf{(b)}}{1000}$ <p>Answer given to 3 or 4 sf</p> | 1 |
| 1(c)(ii) | <p>Correctly calculates ans(ii) = ans(i) Answer given to 3 or 4 sf</p> | 1 |

| Question | Answer | Marks |
|-----------|--|-------|
| 1(c)(iii) | Correct use ans(ii) / 0.0250 (or equivalent) Answer given to 3 or 4 sf | 1 |
| 1(c)(iv) | Correct expression 32.5 / ans(iii) – 159.6 | 1 |
| | Correct answer x = nearest integer to $\frac{[32.5 / \text{ans(iii)} - 159.6]}{18}$ | 1 |
| 1(d)(i) | Correct expression Use of $\frac{0.1(0)}{\text{any accurate titre}} \times 100$ | 1 |
| 1(d)(ii) | The volume from the burette has a smaller error / more precise | 1 |
| | FA 3 is in excess | 1 |

| Question | Answer | Marks |
|-----------|--|----------|
| 2(a) | I Table of data Must show all of the following: <ul style="list-style-type: none"> • mass of crucible (+ lid) • mass of crucible (+ lid) + FA 5 • mass of crucible (+ lid) + residue • mass of FA 5 • mass of residue • mass of water lost | 1 |
| | II Recording of data <ul style="list-style-type: none"> • Unit / g, (g) or in grams for all data recorded • all three balance readings recorded to same number of dp | 1 |
| | III Correctly calculates <ul style="list-style-type: none"> • mass of FA 5, • mass of residue, • mass of water lost | 1 |
| | Examiner checks supervisor's subtraction for mass of FA 5 and mass of residue and calculates the ratio mass of FA 5 ÷ mass of residue to 2 dp. Examiner compares candidate's value with that of Supervisor. | |
| | Award IV if $\delta \leq 0.10$ | 1 |
| | Award V if $\delta \leq 0.05$ | 1 |
| 2(b)(i) | Correctly uses (i) = mass of residue / 208.3 Answer given to 2–4 sf | 1 |
| 2(b)(ii) | Correctly calculates (ii) = mass of water lost / 18 Answer given to 2–4 sf | 1 |
| 2(b)(iii) | Correctly calculates (ii) ÷ (i) and y as an integer | 1 |

| Question | Answer | Marks |
|----------|---|-------|
| 2(c)(i) | Greater mass lost / smaller mass of residue / fewer moles of residue / greater mass of water (appears to be lost) | 1 |
| | so y would be greater | 1 |
| 2(c)(ii) | heat to constant mass OWTTE / cooling in a desiccator | 1 |

| Question | Answer | Marks |
|---|--|-------|
| FA 6 is $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$; FA 7 is $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ | | |
| 3(a)(i) | FA 6 (Heating) produces water vapour / steam / moisture or condensation / solution / liquid forms / melts / dissolves AND FA 7 (Heating) produces water vapour / steam / moisture or condensation / solution / liquid forms / melts | 1 |
| | FA 6 (stronger heating) gives a white solid/ residue AND FA 7 a yellow / green / brown / black solid/ residue | 1 |
| | Gas / chlorine / Cl_2 from heating FA 7 bleaches damp litmus paper or Gas / hydrogen chloride / HCl from heating FA 7 turns litmus red. | 1 |
| 3(a)(ii) | water | 1 |

| Question | Answer | Marks | | | | | | | | | | | | | | |
|--|--|---|---------------------|------|------|---|---|-----------------|---|---|-----------|----------------------------------|------------------------|----------------------------------|-----------|---|
| 3(b)(i) | Clear presentation of results to show FA 6 and FA 7 and two or more reagents. | 1 | | | | | | | | | | | | | | |
| | Uses NaOH(aq) and NH ₃ (aq). | 1 | | | | | | | | | | | | | | |
| | <table border="1" data-bbox="322 395 1339 715"> <thead> <tr> <th></th> <th>FA 6</th> <th>FA 7</th> </tr> </thead> <tbody> <tr> <td>NaOH</td> <td>white ppt and no change / insoluble with excess</td> <td>(pale / light) blue ppt and no change / insoluble with excess</td> </tr> <tr> <td>NH₃</td> <td>white ppt and no change / insoluble with excess</td> <td>(pale) blue ppt and dark / deep blue solution with excess</td> </tr> </tbody> </table> <p>Two boxes correct for each mark.</p> | | FA 6 | FA 7 | NaOH | white ppt and no change / insoluble with excess | (pale / light) blue ppt and no change / insoluble with excess | NH ₃ | white ppt and no change / insoluble with excess | (pale) blue ppt and dark / deep blue solution with excess | 2 | | | | | |
| | | FA 6 | FA 7 | | | | | | | | | | | | | |
| NaOH | white ppt and no change / insoluble with excess | (pale / light) blue ppt and no change / insoluble with excess | | | | | | | | | | | | | | |
| NH ₃ | white ppt and no change / insoluble with excess | (pale) blue ppt and dark / deep blue solution with excess | | | | | | | | | | | | | | |
| 3(b)(ii) | <table border="1" data-bbox="322 813 1527 1171"> <thead> <tr> <th rowspan="2"><i>test</i></th> <th colspan="2"><i>observations</i></th> </tr> <tr> <th>FA 6</th> <th>FA 7</th> </tr> </thead> <tbody> <tr> <td>+ Ba²⁺(aq)</td> <td>white ppt</td> <td>no reaction / no ppt / no change</td> </tr> <tr> <td>+ excess of HCl or HNO₃</td> <td>insoluble</td> <td>no reaction / no ppt / no change</td> </tr> <tr> <td>+ Ag⁺(aq)</td> <td>no reaction / no ppt / no change</td> <td>white ppt</td> </tr> </tbody> </table> <p>Two boxes correct for each mark.</p> | <i>test</i> | <i>observations</i> | | FA 6 | FA 7 | + Ba ²⁺ (aq) | white ppt | no reaction / no ppt / no change | + excess of HCl or HNO ₃ | insoluble | no reaction / no ppt / no change | + Ag ⁺ (aq) | no reaction / no ppt / no change | white ppt | 3 |
| <i>test</i> | <i>observations</i> | | | | | | | | | | | | | | | |
| | FA 6 | FA 7 | | | | | | | | | | | | | | |
| + Ba ²⁺ (aq) | white ppt | no reaction / no ppt / no change | | | | | | | | | | | | | | |
| + excess of HCl or HNO ₃ | insoluble | no reaction / no ppt / no change | | | | | | | | | | | | | | |
| + Ag ⁺ (aq) | no reaction / no ppt / no change | white ppt | | | | | | | | | | | | | | |
| 3(b)(iii) | FA 6 contains Mg ²⁺ / magnesium and SO ₄ ²⁻ / sulfate FA 7 contains Cu ²⁺ / copper(II) and Cl ⁻ / chloride 1 mark for 2 correct ions | 2 | | | | | | | | | | | | | | |