Cambridge International AS & A Level

**Cambridge Assessment International Education**
Cambridge International Advanced Subsidiary and Advanced Level

**CHEMISTRY** **9701/35**

Paper 35 (Advanced Practical Skills 1) **May/June 2018**

MARK SCHEME

Maximum Mark: 40

**Published**

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.

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## Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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| GENERIC MARKING PRINCIPLE 5:<br><br>Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen). |
| GENERIC MARKING PRINCIPLE 6:<br><br>Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind. |

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| Question | Answer | Marks |
|---|---|---|
| 1(a) | **I** Three masses recorded **and**<br>two burette readings and titre for the rough titration **and** initial and final readings for two (or more) accurate titrations<br>(*minimum 2 ×2 box*) | **1** |
| | **II** All **three** headings and units correct for accurate titrations<br>Headings: initial / final (burette) **and** reading / volume / vol<br>**or** reading / volume / vol at start / finish (but not V)<br>**and**<br>volume / **FA 2 and** added / used **or** titre<br>**and**<br>Units: ($cm^3$) **or** / $cm^3$ **or** in $cm^3$ [or $cm^3$ by every entry] | **1** |
| | **III** All accurate burette readings are recorded to the nearest 0.05 $cm^3$<br>*The requirement to record to 0.05 applies to burette readings, including 0.00 (if this was the initial reading) but it does not apply to the titre.*<br>*Do **not** award this mark if:*<br>• *50(.00) is used as an initial burette reading;*<br>• *more than one final burette reading is 50(.00);*<br>• *any burette reading is greater than 50(.00);*<br>• *there is only one accurate titration* | **1** |
| | **IV** The **final** accurate titre recorded is within 0.10 $cm^3$ of any other accurate titre.<br>• *Do **not** award the mark if any 'accurate' burette readings (apart from initial 0) are given to **zero** dp.* | **1** |
| For assessment of accuracy (Q marks) the examiner should round any burette reading to the nearest 0.05 $cm^3$. Subtractions should be checked.<br>The 'best' titres should be selected using the hierarchy:<br>two (or more) identical; then 2 (or more) within 0.05 $cm^3$; then two (or more) within 0.1 $cm^3$ etc.<br>These best titres should be used to calculate the mean corrected titre to the nearest 0.01 $cm^3$.<br>Calculate mean titre/mass used to 2 dp, calculate the supervisor titre/mass, calculate the difference, $\delta$, and award accuracy (Q) marks as shown below. | | |
| 1(a) | **V, VI and VII**<br>Award **V, VI and VII** for a difference from supervisor within 0.10<br>Award **V and VI** for a difference from supervisor $0.10 < \delta \leqslant 0.20$<br>Award **V** for a difference from supervisor $0.20 < \delta \leqslant 0.30$ | **3** |

| Question | Answer | Marks |
|---|---|---|
| 1(b) | Candidate must average two (or more) for which the total spread is not greater than 0.2 $cm^3$.<br>Working must be shown or ticks must be put next to the two (or more) accurate readings selected.<br>*The mean should normally be quoted to 2 dp rounded to the nearest 0.01. Example: 26.667 must be rounded to 26.67.*<br>*Two special cases where the mean may not be to 2 dp:*<br>*allow mean to 3 dp only for 0.025 or 0.075 e.g. 26.325;*<br>*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.*<br>*Do **not** award this mark if:*<br>*any selected titre is not within 0.20 $cm^3$ of any other selected titre;*<br>*the rough titre was used to calculate the mean;*<br>*the candidate carried out only 1 accurate titration;*<br>*burette readings were incorrectly subtracted to obtain any of the accurate titre values.*<br>*All burette readings, excluding initial 0, (resulting in titre values used in calculation of mean) are integers.* | **1** |
| | *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.* | |
| 1(c)(i) | Answers to **(c)(ii)**–**(iv)** correct to 3 or 4 sig figs. (minimum of 3 answers attempted) | **1** |
| 1(c)(ii) | Correctly calculates moles acid = **(b)** × 0.110 / 1000 | **1** |
| 1(c)(iii) | $Na_2CO_3$(aq) + **2**HC*l*(aq) → **2**NaC*l*(**aq**) + $CO_2$(**g**) + $H_2O$(**l**)<br>**and**<br>correctly uses moles sodium carbonate = **(c)(ii)** ÷ 2 | **1** |
| 1(c)(iv) | Correctly uses **(c)(iii)** × 10<br>**and**<br>$M_r$ = mass from **(a)** ÷ (answer to **(c)(iii)** × 10) | **1** |
| 1(c)(v) | $\frac{M_r - 106}{18}$ **and** answer as integer from working | **1** |
| 1(d) | **Percentage** error increases as volume is smaller. | **1** |
| | **Half** the volume of sulfuric acid is needed | **1** |

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| Question | Answer | Marks |
|---|---|---|

| Question | Answer | Marks |
|---|---|---|
| 2(a) | Data recorded (in table) showing all headings and units<br>• Mass of crucible + lid<br>• Mass of crucible + lid + **FA 4**<br>• Mass of crucible + lid + residue / anhydrous **FA 4**<br>• Mass of **FA 4**<br>• Mass residue / anhydrous **FA 4**<br>• Mass water (lost)<br>**and** the 3 balance readings clearly recorded to consistent number of dp.<br>*Do not allow weight*. | **1** |
| | Mass between 1.80 g and 2.00 g used<br>**and**<br>masses water, hydrated and anhydrous solid correctly calculated | **1** |

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| Question | Answer | Marks |
|---|---|---|
| For assessment of accuracy (Q) marks the examiner should check and correct the masses of water and anhydrous solid and calculate ratio of mass water/mass anhydrous solid correct to 2 dp.<br>(theoretical value 1.05) | | |
| 2(a) | Award 2 marks if ratio 0.95–1.10<br>Award 1 mark if ratio 0.80–1.15 | **2** |
| 2(b)(i) | Correctly calculates: mass water for **(a)** ÷ 18, to 2 – 4 sf | **1** |
| 2(b)(ii) | Correctly uses **(b)(i)** ÷ 7 **and** answer to 2 – 4 sf | **1** |
| 2(b)(iii) | Expression: $M_r$ = mass anhydrous solid ÷ **(b)(ii)** | **1** |
| | Expression: $A_r = M_r - 96.1$ | **1** |
| 2(b)(iv) | Identification of **Y** as Group 2 element with $A_r$ nearest to **(b)(iii)** | **1** |
| 2(c) | Moles / mass water too small / not all water lost so $A_r$ too large ….. | **1** |
| | …. as moles **Y**$SO_4$ too small | **1** |

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| Question | Answer | Marks |
|---|---|---|
| | **FA 4** is $MgSO_4$; **FA 5** is $FeSO_4.7H_2O$ | |
| 3(a)(i) | Chooses NaOH and $NH_3$ | **1** |
| | Uses both reagents in excess | **1** |
| | White ppt **and** insoluble in excess for both | **1** |
| 3(a)(ii) | If $Mg^{(2+)}$ in **Q2** then (observations) **confirm** it (owtte)<br>**or**<br>If other cation / metal identified in **Q2** then **not confirmed** as (**FA 4** contains) $Mg^{2+}$ / magnesium (owtte) | **1** |
| 3(b)(i) | Observations (4 possible):<br>• Water vapour / condensation<br>• Gas turns litmus red<br>• White smoke (not white fumes / white gas)<br>• Brown / yellow / grey residue<br>Any 3 obs = 2 marks, any 2 obs = 1 mark | **2** |

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(b)(ii)</td><td>
<table>
<tr><th>test</th><th>observations</th></tr>
<tr><td>+ NaOH</td><td>Green ppt and insol in excess / turns brown [1]</td></tr>
<tr><td>+ $KMnO_4$</td><td>Purple to colourless / yellow [1]</td></tr>
<tr><td>+ $NH_4SCN$</td><td>Red / blood-red / blood-orange (solution) [1]</td></tr>
<tr><td>+$H_2O_2$</td><td>Fizz and gas relights glowing splint [1]</td></tr>
<tr><td>then + NaOH</td><td>Brown / rust / red-brown ppt and insol in excess [1]</td></tr>
<tr><td>+ $AgNO_3$</td><td>No visible reaction / no change / no ppt (ignore faint white ppt) and</td></tr>
<tr><td>+ $Ba(NO_3)_2$</td><td>White ppt and</td></tr>
<tr><td>then + HCl</td><td>(ppt) insoluble [1]</td></tr>
</table>
</td><td>6</td></tr>
<tr><td>3(b)(iii)</td><td>$Fe^{2+}$ and $SO_4^{2-}$</td><td>1</td></tr>
<tr><td>3(b)(iv)</td><td>redox / $Fe^{2+}$ is oxidised / $MnO_4^-$ is reduced</td><td>1</td></tr>
</table>

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