Cambridge International AS & A Level

**Cambridge International Examinations**
Cambridge International Advanced Subsidiary and Advanced Level

**CHEMISTRY** **9701/34**

Paper 3 Advanced Practical Skills 2 **October/November 2016**

MARK SCHEME

Maximum Mark: 40

**Published**

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| Question | Answer | Marks |
|---|---|---|
| 1(a) | **I** Mass of magnesium recorded with /g or (g)<br>**and**<br>initial and final burette readings and volume of hydrogen with unambiguous headings and correct unit.<br><br>Examiner to calculate 10% and 20% of Supervisor's volume and round this to 1 dp.<br><br>Candidate's volume compared with Supervisor's volume.<br><br>Award **II** if within 20%<br>Award **II** and **III** if within 10% | 1<br><br><br><br><br><br><br>1<br>1<br>**3** |
| 1(b)(i) | Correct calculation moles $H_2$ = $\frac{\text{volume collected}}{24000}$ to 2 – 4 sf<br>Volume of gas must be correctly calculated. | 1 |
| 1(b)(ii) | Correctly uses $A_r$ = $\frac{\text{mass used}}{\textbf{(i)}}$ to 2 – 4 sf | 1<br><br><br>**2** |

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| Question | Answer | Marks |
|---|---|---|
| 1(c)(i) | Correct expression<br>Error in mass = $\frac{0.1 \text{ or } 0.01 \text{ or } 0.001}{\text{mass of Mg}} \times 100^{*}$ (depending on dp of balance)<br><br>Correct expression<br>Error in volume = $\frac{0.1 \times 100^{*}}{\text{volume of gas in } \textbf{(a)}}$ | 1<br><br>1 |
| 1(c)(ii) | Use a larger mass of magnesium (*for either*)/use a balance that reads to more dp (*mass error was larger*)/use a burette more precisely calibrated/smaller graduations (*volume error was larger*) | 1<br><br>**3** |

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| Question | Answer | Marks |
|---|---|---|
| 1(d) | Volume (gas) measured/**or** moles/amount gas/$H_2$ would have been less<br>$A_r$ greater but must follow from smaller **moles** of $H_2$/Mg<br>**or**<br>Use correct molar volume for new room temperature<br>$A_r$ unchanged (but must follow from $V_m$ smaller) | 1<br>1<br><br>**or**<br>1<br>1<br><br>**2** |
| | **Total:** | **10** |

| Question | Answer | Marks |
|---|---|---|
| 2(a) | **I** Initial and final burette readings and volume added recorded for rough titre<br>**and**<br>initial and final reading for **two** (or more) accurate titrations<br><br>**II** Initial and final burette readings and volume of **FB 3** added recorded for each accurate titration.<br>Headings and units correct for accurate titrations.<br>Heading: initial/final (burette) reading/volume **or** reading/volume at start/finish<br>**and**<br>volume/**FB 3** added/used or titre (**not** difference/amount/total unless total as an extra with volume used/ titre,)<br>**and**<br>Units: ($cm^3$) **or**/ $cm^3$ or in $cm^3$ or $cm^3$ by every entry | 1<br><br><br><br>1 |

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| Question | Answer | Marks |
|---|---|---|
| | **III** All accurate burette readings recorded to the nearest 0.05 $cm^3$<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 > 50(.00)* | 1 |
| | **IV** Final uncorrected titre is within 0.10 $cm^3$ of any previous uncorrected accurate titre. | 1 |
| | Examiner rounds any accurate burette readings to the nearest 0.05 $cm^3$, checks subtractions and then selects the 'best' accurate titres using the hierarchy: identical titres; titres within 0.05 $cm^3$; titres within 0.1 $cm^3$; etc., to calculate mean correct to 0.01 $cm^3$.<br><br>Examiner compares candidate's titre value with that of the Supervisor.<br><br>**V, VI** and **VII**<br>Award **V, VI** and **VII** for $\delta \leq 0.20\,cm^3$<br>Award **V** and **VI** for $0.20\,cm^3 < \delta \leq 0.30\,cm^3$<br>Award **V** for $0.30\,cm^3 < \delta \leq 0.50\,cm^3$ | 1<br>1<br>1<br>**7** |
| 2(b) | Calculation of mean<br>Check mean titre is correctly calculated from clearly selected values (ticks or working)<br>• Candidate must average two (or more) titres where the total spread is $\leq 0.20\,cm^3$.<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. [*e.g.* 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 (ignoring initial given | 1 |

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| Question | Answer | Marks |
|---|---|---|
| | as 0) 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>• 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 (resulting in titre values used in the calculation of the mean) are integers.<br>*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** |
| 2(c)(i) | Correctly calculates<br>$\frac{2.64}{106 \times 40} = 6.23 / 6.225 / 6.226 \times 10^{-4}$ | 1 |
| 2(c)(ii) and 2(c)(iii) | Correctly uses **(i)** $\times$ 2<br>**and**<br>$\frac{\textbf{(ii)} \times 250}{\textbf{(b)}}$ | 1 |
| 2(c)(iv) | Correctly calculates<br>Moles HC*l* = $\frac{30 \times 1.00}{1000}$ = 0.03(00) | 1 |

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| Question | Answer | Marks |
|---|---|---|
| 2(c)(v) and 2(c)(vi) | Correctly uses<br>**(iv)** – **(iii)**<br>**and**<br>$\frac{0.21}{\textbf{(v)}} \times 2$<br><br>Answers to 3 or 4 sf<br>(*minimum 4 answers attempted, allow 2 sf in **(vi)***) | 1<br><br>1<br><br>**5** |
| 2(d)(i) | **Half** the volume needed since 1:1 ratio/1 mole NaOH in equation | 1 |
| 2(d)(ii) | (Impure) since absorbed/reacted with $CO_2$ **or** water vapour/water from the air | 1<br>**2** |
| | **Total** | **15** |

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td colspan="3">FB 5 is $CH_3COCH_3$ FB 6 is $C_2H_5OH$ FB 7 is $C_2H_5CHO$ FB 8 is $Cu(NO_3)_2$</td></tr>
<tr><td>3(a)(i)</td><td>
<table>
<tr><th></th><th>FB 5</th><th>FB 6</th><th>FB 7</th></tr>
<tr><td>Acidified $MnO_4^-$</td><td>no reaction</td><td colspan="2">Purple to colourless (solution)/(solution) turns colourless</td></tr>
<tr><td>KI + ClO$^-$</td><td colspan="2">(Pale) yellow/cream solid/ppt</td><td>no reaction</td></tr>
<tr><td>Tollens’</td><td colspan="2">no reaction</td><td>Silver/black/ (dark) grey solid/ ppt/silver mirror</td></tr>
</table>
</td><td>1<br>1<br>1</td></tr>
<tr><td>3(a)(ii)</td><td>FB 5 is propanone, FB 6 is ethanol, FB 7 is propanal</td><td>1</td></tr>
</table>

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| Question | Answer | Marks |
|---|---|---|
| 3(a)(iii) | Reagent: 2,4–dinitrophenylhydrazine/2,4–DNP(H)/Brady's reagent<br>Result: propanone and propanal: orange/yellow **and** solid/ppt (not red)<br>ethanol: no reaction/stays yellow (allow remains colourless)<br>**or**<br>Reagent: $SOCl_2$/$PCl_3$/$PCl_5$<br>Result: propanone and propanal: no visible reaction/no misty fumes<br>ethanol: steamy/misty fumes (allow white fumes)<br>**or**<br>Reagent: ethanoic acid + conc $H_2SO_4$ (and warm)<br>Result: propanone and propanal: no reaction/ no sweet smell<br>ethanol: sweet/ fruity smell<br>**or**<br>Reagent: Na<br>Result: propanone and propanal: no reaction/ no bubbles<br>ethanol: effervescence/ bubbling/ fizzing | 1<br>1<br><br>**or**<br><br>1<br>1<br><br>**or**<br><br>1<br>1<br><br>**or**<br><br>1<br>1 |
| 3(a)(iv) | Reagent: Fehling's/Benedict's/Sandell's<br>Result: ethanol and propanone: no reaction/stays/turns blue<br>propanal**:** orange/red/brick-red solid/ ppt | 1<br><br>1<br>**8** |
| 3(b)(i) | (Pale) blue ppt (not dark blue) | 1 |
| 3(b)(ii) | **Black** solid | 1 |
| 3(b)(iii) | Blue/green solution | 1 |

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| Question | Answer | Marks |
|---|---|---|
| 3(b)(iv) | Any **two** of<br>• effervescence/bubbling/fizzing<br>• solid goes pink/brown (allow red-brown)<br>• blue/colour of solution fades (owtte) | 1 |
| 3(b)(v) | Oxygen relights glowing splint<br>**or**<br>nitrogen dioxide is brown | 1 |
| 3(b)(vi) | $Cu(NO_3)_2$ | 1 |
| 3(b)(vii) | $Cu^{2+}(aq) + 2OH^-(aq) \rightarrow Cu(OH)_2(s)$ | 1<br>**7** |
| | **Total:** | **15** |

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