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

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 October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

Question	Answer	Marks
1(a)	**I** Mass of magnesium recorded with /g or (g) **and** initial and final burette readings and volume of hydrogen with unambiguous headings and correct unit. Examiner to calculate 10% and 20% of Supervisor's volume and round this to 1 dp. Candidate's volume compared with Supervisor's volume. Award **II** if within 20% Award **II** and **III** if within 10%	1 1 1 **3**
1(b)(i)	Correct calculation moles H_2 = $\frac{\text{volume collected}}{24000}$ to 2 – 4 sf 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 **2**

Question	Answer	Marks
1(c)(i)	Correct expression 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) Correct expression Error in volume = $\frac{0.1 \times 100^{*}}{\text{volume of gas in } \textbf{(a)}}$	1 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 **3**

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

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

Question	Answer	Marks
	III All accurate burette readings recorded to the nearest 0.05 cm^3 *Do not award this mark if:* *50(.00) is used as an initial burette reading;* *more than one final burette reading is 50(.00)* *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. Examiner compares candidate's titre value with that of the Supervisor.	
	V, VI and **VII** Award **V, VI** and **VII** for $\delta \leq 0.20\ cm^3$ Award **V** and **VI** for $0.20\ cm^3 < \delta \leq 0.30\ cm^3$ Award **V** for $0.30\ cm^3 < \delta \leq 0.50\ cm^3$	1 1 1 **7**
2(b)	Calculation of mean Check mean titre is correctly calculated from clearly selected values (ticks or working) • Candidate must average two (or more) titres where the total spread is $\leq 0.20\ cm^3$. • Working must be shown or ticks must be put next to the two (or more) accurate readings selected. • 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] 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 (ignoring initial given	1

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.] Do **not** award this mark if: • the rough titre was used to calculate the mean; • the candidate carried out only 1 accurate titration; • burette readings were incorrectly subtracted to obtain any of the accurate titre values; • **all** burette readings (resulting in titre values used in the calculation of the mean) are integers. *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 $\frac{2.64}{106 \times 40} = 6.23 / 6.225 / 6.226 \times 10^{-4}$	1
2(c)(ii) and 2(c)(iii)	Correctly uses **(i)** $\times$ 2 **and** $\frac{\textbf{(ii)} \times 250}{\textbf{(b)}}$	1
2(c)(iv)	Correctly calculates Moles HCl = $\frac{30 \times 1.00}{1000}$ = 0.03(00)	1

Question	Answer	Marks
2(c)(v) and 2(c)(vi)	Correctly uses **(iv) – (iii)** **and** $\frac{0.21}{\textbf{(v)}} \times 2$ Answers to 3 or 4 sf (*minimum 4 answers attempted, allow 2 sf in **(vi)**)*	1 1 **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 **2**
	Total	**15**

<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
1
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>

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

Question	Answer	Marks
3(b)(iv)	Any **two** of • effervescence/bubbling/fizzing • solid goes pink/brown (allow red-brown) • blue/colour of solution fades (owtte)	1
3(b)(v)	Oxygen relights glowing splint **or** 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 **7**
	Total:	**15**