Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CHEMISTRY **9701/33**

Paper 3 Advanced Practical Skills **March 2017**

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 March 2017 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

Question	Answer	Marks
1(a)	**M1** unambiguous recording of volume of oxygen gas with unit	**1**
	M2 volume of gas within 10% of the supervisor's value	**1**
1(b)(i)	correctly calculates **V(a)** ÷ 150 to 2–4 sig. fig.	**1**
1(b)(ii)	correctly calculates $\frac{\mathbf{V(a)}}{24.0 \times 1000}$ to 2–4 sig. fig.	**1**
1(b)(iii)	correctly uses **(ii)** × 2 **AND** answer to 2–4 sig. fig.	**1**
1(b)(iv)	shows working $\frac{(\mathbf{iii}) \times 1000}{150}$ **AND** answer to 2–4 sig. fig.	**1**
1(c)(i)	MnO_2 in (ignition) tube / floating in weighing boat **OR** use a dropping funnel / syringe for H_2O_2 **AND** subtract the liquid volume	**1**
1(c)(ii)	**M1** $\frac{0.5 \times 100}{50}$ = 1.0%	**1**
	M2 × 3 = 3.0% (3.0 with no working shown scores [2].)	**1**
1(c)(iii)	(agree as) two readings to find volume of gas evolved are needed so there is twice the percentage error in the gas volume reading	**1**
1(d)	no change because MnO_2 / **FA 2** / solid is a catalyst	**1**

Question	Answer	Marks
2(a)	**I** initial and final burette readings and volume added recorded for rough titre **AND** accurate titre details tabulated	**1**
	II initial and final burette readings recorded and volume of **FA 3** added recorded for each accurate titration • all headings and units correct for accurate titrations – initial / final (burette) reading / volume **OR** reading / volume at start / finish – titre **OR** volume **FA 3** added / used – (cm^3) **OR** / cm^3 **OR** in cm^3 by every entry	**1**
	III all accurate burette readings are recorded to the nearest 0.05 cm^3	**1**
	IV final titre within 0.10 cm^3 of any previous accurate titre	**1**
	V, VI and **VII** award **V**, **VI** and **VII** for $\delta \leqslant 0.20\,cm^3$ award **V** and **VI** for $0.20\,cm^3 < \delta \leqslant 0.30\,cm^3$ award **V** for $0.30\,cm^3 < \delta \leqslant 0.50\,cm^3$	**3**
2(b)	mean titre correctly calculated from clearly selected values: • candidate must average two (or more) titres where the **total** spread is $\leqslant 0.20\,cm^3$ • 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 d.p. rounded to the nearest 0.01 *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)	**M1** correctly calculates $\frac{0.030 \times (\mathbf{b})}{1000}$	**1**
	M2 correctly uses **(i)** × 5/2	**1**
	M3 correctly uses **(ii)** × 1000/25	**1**
	M4 all final answers to 3 or 4 sig. fig. (minimum two parts attempted)	**1**

Question	Answer	Marks
	FA 5 is $C_6H_{12}O_6(aq)$; **FA 6** is $(NH_4)_2Fe(SO_4)_2(aq)$; **FA 7** is $NaNO_2(aq)$	
3(a)(i)–(iv)	see below	**11**

test	**FA 5**	**FA 6**	**FA 7**
(i) aqueous sodium hydroxide, then	no reaction / no ppt. **AND**	green ppt. **AND** insol in excess / turning brown **1**	no reaction / no change / no ppt. **AND**
warm gently	solution turns yellow / yellow-brown / brown **1**	gas / NH_3 turns (damp red) litmus (paper) blue **1**	no reaction / solution remains colourless **1**
aluminium foil and warm	effervescence with **FA 5 or FA 7**	**AND**	gas / NH_3 turns (damp red) litmus (paper) blue **1**
(ii) acidified aqueous potassium manganate (VII)	no reaction **AND**	purple decolourises / solution turns yellow **AND**	purple decolourises / turns colourless **1**
warm gently	purple decolourises / turns colourless **1**		
(iii) hydrogen peroxide		solution turns yellow / effervescence **AND**	no reaction / no change **1**
		gas relights glowing splint **1**	
(iv) hydrochloric acid, then		no reaction / no change / no ppt.	brown gas / colourless bubbles / gas turning brown in air / blue solution
Ba^{2+} (aq)		**AND** white ppt. **1**	**AND** no reaction **1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(b)(i)</td><td>
<table>
<tr><th></th><th>cation(s)</th><th>anion(s)</th></tr>
<tr><td>FA 5</td><td>unknown</td><td>unknown</td></tr>
<tr><td>FA 6</td><td>Fe^{2+} / iron(II) and NH_4^+ / ammonium</td><td>SO_4^{2-} / sulfate</td></tr>
<tr><td>FA 7</td><td>unknown</td><td>NO_2^- / nitrite</td></tr>
</table>
</td><td>3</td></tr>
<tr><td>3(b)(ii)</td><td>clearly shows the reagent and expected observation(s)</td><td>1</td></tr>
<tr><td></td><td>add NH_3 AND green ppt. AND insoluble in an excess of ammonia / turning brown (on standing)</td><td>1</td></tr>
<tr><td>3(b)(iii)</td><td>$Fe^{2+}(aq) + 2OH^-(aq) \rightarrow Fe(OH)_2(s)$
OR
$[Fe(H_2O)_6]^{2+}(aq) + 2NH_3(aq) \rightarrow [Fe(OH)_2(H_2O)_4](s) + 2NH_4^+(aq)$</td><td>1</td></tr>
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