

Cambridge International Examinations Cambridge International Advanced Subsidiary and Advanced Level

#### CHEMISTRY

9701/33 March 2017

Paper 3 Advanced Practical Skills MARK SCHEME Maximum Mark: 40

Published

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## Cambridge International AS/A Level – Mark Scheme PUBLISHED

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 $\frac{V(a)}{24.0 \times 1000}$ to 2–4 sig. fig.	1
1(b)(iii)	correctly uses (ii) $\times$ 2 AND answer to 2–4 sig. fig.	1
1(b)(iv)	shows working $\frac{(iii) \times 1000}{150}$ 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)	$\mathbf{M1} \ \frac{0.5 \times 100}{50} = 1.0\%$	1
	$M2 \times 3 = 3.0\%$ (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 <sub>2</sub> /FA 2/solid is a catalyst	1

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Question	Answer	Marks
2(a)	I initial and final burette readings and volume added recorded for rough titre AND accurate titre details tabulated	1
	<ul> <li>II initial and final burette readings recorded and volume of FA 3 added recorded for each accurate titration</li> <li>all headings and units correct for accurate titrations         <ul> <li>initial/final (burette) reading/volume OR reading/volume at start/finish</li> <li>titre OR volume FA 3 added/used</li> <li>(cm<sup>3</sup>) OR / cm<sup>3</sup> OR in cm<sup>3</sup> by every entry</li> </ul> </li> </ul>	1
	<b>III</b> all accurate burette readings are recorded to the nearest 0.05 cm <sup>3</sup>	1
	IV final titre within 0.10 cm <sup>3</sup> of any previous accurate titre	1
	<b>V</b> , <b>VI</b> and <b>VII</b> award <b>V</b> , <b>VI</b> and <b>VII</b> for $\delta \le 0.20 \text{ cm}^3$ award <b>V</b> and <b>VI</b> for 0.20 cm <sup>3</sup> < $\delta \le 0.30 \text{ cm}^3$ award <b>V</b> for 0.30 cm <sup>3</sup> < $\delta \le 0.50 \text{ cm}^3$	3
2(b)	<ul> <li>mean titre correctly calculated from clearly selected values:</li> <li>candidate must average two (or more) titres where the total spread is ≤ 0.20 cm<sup>3</sup></li> <li>working must be shown or ticks must be put next to the two (or more) accurate readings selected</li> <li>the mean should normally be quoted to 2 d.p. rounded to the nearest 0.01</li> </ul> Note: the candidate's mean will sometimes be marked as correct even if it is different from the mean calculated by the	1
	examiner for the purpose of assessing accuracy.	
2(c)	<b>M1</b> correctly calculates $\frac{0.030 \times (\mathbf{b})}{1000}$	1
	M2 correctly uses (i) $\times$ 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

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estion		Answer				М	
		<b>FA 5</b> is C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> (aq); <b>F</b>	4 6	<b>6</b> is (NH <sub>4</sub> ) <sub>2</sub> Fe(SO <sub>4</sub> ) <sub>2</sub> (aq); <b>FA 7</b> is NaN(	<b>O</b> <sub>2</sub>	(aq)	
i)–(iv)	see below						
	test	FA 5		FA 6		FA 7	
(i) aqu hydrox	leous sodium kide, then	no reaction/no ppt. <b>AND</b>		green ppt. <b>AND</b> insol in excess/ turning brown 1	.	no reaction/no change/no ppt. <b>AND</b>	
warm	gently	solution turns yellow/yellow- brown/brown	1	gas/NH <sub>3</sub> turns (damp red) litmus (paper) blue <b>1</b>		no reaction/solution remains colourless	1
aluminium foil and warm		effervescence with FA 5 or FA 7	,	AND		gas/NH <sub>3</sub> turns (damp red) litmus (paper) blue	1
(ii) acidified aqueous potassium manganate (VII)		no reaction AND		purple decolourises/solution turns yellow <b>AND</b>		purple decolourises/turns colourless	1
warm	gently	purple decolourises/turns colourless	1				
<i>(</i>							
(iii) hydrogen peroxide				solution turns yellow/ effervescence <b>AND</b>		no reaction/no change	1
				gas relights glowing splint 1			
<b>(iv)</b> hy	drochloric hen			no reaction/no change/no ppt.		brown gas/colourless bubbles/g turning brown in air/blue solution	as
acid, t			_		1		

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	FUBLISHED				
Answer					
	cation(s)	anion(s)	3		
FA 5	unknown	unknown			
FA 6	Fe <sup>2+</sup> /iron(II) and NH <sub>4</sub> <sup>+</sup> /ammonium	SO <sub>4</sub> <sup>2-</sup> /sulfate			
<b>FA</b> 7	unknown	NO <sub>2</sub> <sup>-</sup> /nitrite			
clearly shows the reagent and expected observation(s)					
add NH <sub>3</sub> AND green pp	t. AND insoluble in an excess of ammonia/turn	ning brown (on standing)	1		
$Fe^{2+}(aq) + 2OH^{-}(aq) \rightarrow Fe(OH)_{2}(s)$					
$[Fe(H_2O)_6]^{2+}(aq) + 2NF$	$H_3(aq) \rightarrow [Fe(OH)_2(H_2O)_4](s) + 2NH_4^+(aq)$				
_	FA 5FA 6FA 7clearly shows the reageadd NH3 AND green ppFe <sup>2+</sup> (aq) + 2OH <sup>-</sup> (aq) - OR[Fe(H2O)6] <sup>2+</sup> (aq) + 2NH	FOBLISHEDAnswerCation(s)FA 5unknownFA 6 $Fe^{2+}/iron(II)$ and $NH_4^+/ammonium$ FA 7unknownclearly shows the reagent and expected observation(s)add NH <sub>3</sub> AND green ppt. AND insoluble in an excess of ammonia/turnFe <sup>2+</sup> (aq) + 2OH <sup>-</sup> (aq) $\rightarrow$ Fe(OH) <sub>2</sub> (s)OR[Fe(H <sub>2</sub> O) <sub>6</sub> ] <sup>2+</sup> (aq) + 2NH <sub>3</sub> (aq) $\rightarrow$ [Fe(OH) <sub>2</sub> (H <sub>2</sub> O) <sub>4</sub> ](s) + 2NH <sub>4</sub> <sup>+</sup> (aq)	POBLISHEDAnswercation(s)anion(s)FA 5unknownunknownFA 6Fe <sup>2+</sup> /iron(II) and NH <sub>4</sub> <sup>+</sup> /ammoniumSO <sub>4</sub> <sup>2-</sup> /sulfateFA 7unknownNO <sub>2</sub> <sup>-</sup> /nitriteclearly shows the reagent and expected observation(s)add NH <sub>3</sub> AND green ppt. AND insoluble in an excess of ammonia/turning brown (on standing)Fe <sup>2+</sup> (aq) + 2OH <sup>-</sup> (aq) $\rightarrow$ Fe(OH) <sub>2</sub> (s)OR[Fe(H <sub>2</sub> O) <sub>6</sub> ] <sup>2+</sup> (aq) + 2NH <sub>3</sub> (aq) $\rightarrow$ [Fe(OH) <sub>2</sub> (H <sub>2</sub> O) <sub>4</sub> ](s) + 2NH <sub>4</sub> <sup>+</sup> (aq)		

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