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CHEMISTRY

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Paper 3 Advanced Practical Skills 2

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MARK SCHEME

Maximum Mark: 40

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This document consists of **7** printed pages.

Question	Answer	Marks
1(a)	I All the following data is recorded • burette readings and titre for rough titration • initial and final burette readings for two (or more) accurate titrations (<i>i.e.</i> 2×2 box). <i>Headings and units are not required for this mark</i>	1
	II Headings and units correct for accurate titration table and headings match readings. • initial / start (burette) reading / volume • final / end (burette) reading / volume • titre or volume / FB 2 and used / added • units: (cm^3) or / cm^3 or in cm^3 or cm^3 for each volume recorded	1
	III All accurate burette readings to 0.05 cm^3. <i>Do not award this mark if:</i> • <i>50.(00) is used as an initial burette reading;</i> • <i>more than one final burette reading is 50.(00);</i> • <i>any burette reading is greater than 50.(00).</i>	1
	IV The final accurate titre recorded is within 0.10 cm^3 of any other accurate titre.	1
	Examiner rounds any accurate burette readings to the nearest 0.05 cm^3, checks subtractions and then selects the “best” titres using the hierarchy: • identical titres <i>then</i> • accurate titres within 0.05 cm^3, <i>then</i> • accurate titres within 0.10 cm^3, <i>etc.</i> These best titres should be used to calculate the mean titre, expressed to nearest 0.01 cm^3. Examiner compares candidate’s mean titre value with that of the Supervisor.	

9701/36

Question	Answer	Marks
1(a)	Award V and VI if $\delta \leq 0.30 \text{ cm}^3$	1
	Award V if $0.30 < \delta \leq 0.60 \text{ cm}^3$	1
1(b)	Candidate must take the average of two (or more) titres that are within a total spread of not more than 0.20 cm^3. - Working / explanation must be shown or ticks must be put next to the two (or more) accurate readings selected. - The mean should be quoted to 2 dp, and be rounded to nearest 0.01 cm^3. (e.g. 26.666 cm^3 must be rounded to 26.67 cm^3) Two special cases, where the mean need not be to 2 dp: - Allow mean expressed to 3 dp only for 0.025 or 0.075 (e.g. 26.325 cm^3) - Allow mean if expressed 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 allowed) (e.g. 26.0 and $26.1 = 26.1$ is wrong – should be 26.05) <i>Do not award this mark if:</i> - The rough titre was used to calculate the mean. - The candidate did only one accurate titration. - Burette readings were incorrectly subtracted to obtain any of the accurate titre values. - All burette readings used to calculate the mean were recorded as integers	1
1(c)(i)	Correctly calculates number of moles of $\text{MnO}_4^- = \frac{0.02 \times \text{vol in (b)}}{1000}$	1
1(c)(ii)	Correctly uses: (i) $\times 5/2$ (to a minimum of 2 sf)	1

Question	Answer	Marks
1(d)	$(\text{COOH})_2(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow (\text{COONa})_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$	1
1(e)	Table clearly showing 2 (or more) accurate initial and final volumes and titres. Subtraction for titres must be correct.	1
	Examiner rounds any accurate burette readings to the nearest 0.05 cm^3 , checks subtractions and then selects the “best” titres using the hierarchy: - identical titres <i>then</i> - accurate titres within 0.05 cm^3, <i>then</i> - accurate titres within 0.10 cm^3, <i>etc.</i> These best titres should be used to calculate the mean titre, expressed to nearest 0.01 cm^3 . Examiner compares candidate's mean titre value with that of the Supervisor.	
	Award 3 marks if $\delta \leq 0.20 \text{ cm}^3$.	1
	Award 2 marks if $0.20 < \delta \leq 0.40 \text{ cm}^3$.	1
	Award 1 mark if $0.40 < \delta \leq 0.60 \text{ cm}^3$.	1
1(f)(i), (ii) and (iii)	Correctly uses mean in (i) and number of moles of NaOH = $\frac{0.04 \times \text{vol in (i)}}{1000}$ in (ii) and moles $(\text{COOH})_2 = (\text{ii})/2$ in (iii)	1
1(g)(i)	Correctly uses (c)(ii) – (f)(iii)	1
1(g)(ii)	Correctly uses mass $(\text{COONa})_2 = (\text{g})(\text{i}) \times 134$	1
1(g)(iii)	Correctly uses mass $(\text{COOH})_2 = (\text{f})(\text{iii}) \times 90$	1

9701/36

Question	Answer	Marks
1(g)(iv)	Correct expression $\frac{(g)(iii)}{(g)(ii) + (g)(iii)} \times 100$ (or correct answer)	1
	Significant figures mark Answers to (c), (f) and (g) all to 3 or 4 sf (Minimum 6 answers attempted)	1
1(h)(i)	No change • since the number of moles of acid stays the same, or • as the water will not react, or • as the mole ratio stays the same, or • as the concentration of acid (FB 1) stays the same	1
1(h)(ii)	% mass of acid decreases as there is now water as part of the total mass or M_r of (hydrated) acid increases so multiply moles by bigger number so % mass of (hydrated) acid increases	1
1(i)	Would be more accurate since the titre volume is bigger so smaller percentage error.	1

Question	Answer	Marks
FB 5 is $\text{MnCl}_2(\text{aq})$, FB 6 is $(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2(\text{aq})$, FB 7 is $\text{KMnO}_4(\text{aq})$, FB 8 is $\text{KMnO}_4(\text{s})$		
2(a)(i)	sodium hydroxide buff / pale or light brown / fawn / beige / off-white ppt	1
	hydrogen peroxide (turns) dark brown / black solid / ppt	1
	effervescence / bubbling / fizz and gas relights glowing splint	1
2(a)(ii)	green ppt insoluble in excess	1
2(a)(iii)	brown ppt insoluble in excess	1
2(a)(iv)	purple to colourless (allow purple to (pale) yellow / pale orange)	1
2(a)(v)	brown solid / ppt	1
2(a)(vi)	yellow / brown (solution) and blue-black / black / dark blue with starch	1
2(b)	FB 5 manganese / Mn / Mn^{2+} / Mn(II)	1
	FB 6 iron / Fe / Fe^{2+} / Fe(II)	1
	FB 7 manganese / Mn / Mn(VII)	1
2(c)	(iodide ions are) oxidised to iodine / (iodide ions) lose electrons to form iodine / $2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^{(-)}$	1
2(d)(i)	Gas relights glowing splint	1
2(d)(ii)	Green solution / liquid	1

Question	Answer	Marks
2(e)(i)	Tests: (aqueous) silver nitrate and (aqueous) barium nitrate / chloride	1
	white ppt with Ba ²⁺ and insoluble in named acid (not sulfuric acid) and no ppt with Ag ⁺	1
2(e)(ii)	anion = sulfate / SO ₄ ²⁻	1