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CHEMISTRY **9701/36**

Paper 3 Advanced Practical Skills 2 **October/November 2017**

MARK SCHEME

Maximum Mark: 40

Published

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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.e. 2 × 2 box*). *Headings and units are **not** required for this mark*	**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. *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 greater than 50.(00).*	**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 *then* • accurate titres within 0.05 cm^3, *then* • accurate titres within 0.10 cm^3*, etc.* 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.	

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Question	Answer	Marks
1(a)	Award **V** and **VI** if $\delta \leqslant 0.30$ (cm^3)	**1**
	Award **V** if $0.30 < \delta \leqslant 0.60$ 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)* *Do **not** award this mark if:* • *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 MnO_4^- = $\frac{0.02 \times \text{vol in } \textbf{(b)}}{1000}$	**1**
1(c)(ii)	**Correctly uses: (i)** × 5/2 (to a minimum of 2 sf)	**1**

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Question	Answer	Marks
1(d)	$(COOH)_2(aq) + \mathbf{2}NaOH(aq) \rightarrow \mathbf{(COONa)_2(aq)} + \mathbf{2H_2O(l)}$	**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 *then* • accurate titres within 0.05 cm^3, *then* • accurate titres within 0.10 cm^3, *etc.* 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 $\delta \leqslant 0.20\ cm^3$.	**1**
	Award 2 marks if $0.20 < \delta \leqslant 0.40\ cm^3$.	**1**
	Award 1 mark if $0.40 < \delta \leqslant 0.60\ cm^3$.	**1**
1(f)(i), (ii) and (iii)	**Correctly uses** mean in **(i)** **and** number of moles of NaOH $= \frac{0.04 \times \text{vol in } \mathbf{(i)}}{1000}$ in **(ii)** **and** moles $(COOH)_2$ = **(ii)**/2 in **(iii)**	**1**
1(g)(i)	**Correctly uses** **(c)(ii) – (f)(iii)**	**1**
1(g)(ii)	**Correctly uses** mass $(COONa)_2$ = **(g)(i)** × 134	**1**
1(g)(iii)	**Correctly uses** mass $(COOH)_2$ = **(f)(iii)** × 90	**1**

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Question	Answer	Marks
1(g)(iv)	**Correct expression** $\frac{\text{(g)(iii)}}{\text{(g)(ii)} + \text{(g)(iii)}} \times 100$ (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**

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Question	Answer	Marks
	FB 5 is $MnCl_2(aq)$, **FB 6** is $(NH_4)_2Fe(SO_4)_2(aq)$, **FB 7** is $KMnO_4(aq)$, **FB 8** is $KMnO_4(s)$	
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 / $2I^- \rightarrow I_2 + 2e^{(-)}$	**1**
2(d)(i)	Gas relights glowing splint	**1**
2(d)(ii)	Green solution / liquid	**1**

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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**

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