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CHEMISTRY **9701/33**

Paper 3 Advanced Practical Skills 1 **October/November 2016**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1(a)	Initial and final readings and titre value for rough **and** initial and final reading for **two** (or more) accurate titrations	1
	Appropriate headings and units **and** the volume of **FA 2** added is recorded for each accurate titration. Headings must match readings Initial/start (burette) **and** reading/volume Final/end (burette) **and** reading/volume Titre **or** volume/vol/**FA 2 and** used/added (*not "difference", "total", "V"*) Units: /cm^3 or (cm^3) or in cm^3 or cm^3 for each volume.	1
	All accurate burette readings (initial and final) recorded to 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 greater than** 50.(00)*	1
	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 $\delta \leq 0.30\,cm^3$ Award **V** and **VI** for $0.30 < \delta \leq 0.50\,cm^3$ Award **V** only for $0.50 < \delta \leq 0.80\,cm^3$	1 1 1 **7**

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Question	Answer	Marks
1(b)	Calculation of the 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 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 **1**
1(c)(i)	**I** Correctly calculates: $\frac{(b)}{1000} \times 0.0200$	1
1(c)(ii) and 1(c)(iii)	**II** Correctly uses: **(i)** $\times$ 5/2 **and** **(ii)**/0.025 or **(ii)** $\times$ 1000/25	1
1(c)(iv)	Correctly calculates: **(iii)** $\times$ 10 **or** **(ii)** $\times$ 1000/25 $\times$10	1

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Question	Answer	Marks
	3 or 4 significant figures in final answers to all parts (*minimum 3 parts attempted*)	1 **4**
	Total:	**12**

Question	Answer	Marks
2(a)	Examiner to calculate 10% and 20% of Supervisor's time and round this to nearest second. Candidate's time compared with supervisor's time. Award 2 marks if time within 10% of supervisor Award 1 mark if time within 20% of supervisor	**2**
2(b)(i)	Correctly calculates: $2.61 \times 10^{-5} \times$ reaction time from **(a)**	1

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Question	Answer	Marks
2(b)(ii)	Correctly uses: **(i)** × 0.080 **or (i)** × 80/1000 and no additional working	1
2(b)(iii) and 2(b)(iv)	Correctly uses: 2 × ans **(ii)** **and** **(iii)**/0.020 **or** **(iii)** × 1000/20 Time recorded to nearest second in **(a)** and **(c)** **and** 2 – 4 sf in all answers in **(b)** (minimum 3 parts attempted)	1 1 **4**
2(c)	Examiner calculates ratio of reaction time **(a)**/reaction time **(b)** Award if 1.80 ⩽ ratio ⩽ 2.80	1 **1**
2(d)(i)	Time is less/shorter **because** the amount/volume/concentration of **thiosulfate/FA 6** is less (ora) Time is approximately half **because** (the amount/no. of moles/concentration of) the **thiosulfate/FA 6** is **half**.	1 1

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Question	Answer	Marks
2(d)(ii)	(No because) the error is greater in **(c)** with some explanation e.g. because more readings taken/water added The **measuring cylinder** is used more times in **(c)** **or** **smaller volumes**/10 cm^3 instead of 20 cm^3 are measured in **(c)** **or** **6** rather than **5** readings taken/more reagents used/water **also** added/added in addition **or** smaller volumes therefore greater percentage error	1 1 **4**
	Total:	**11**

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Question	Answer	Marks
	FA 7 is $ZnSO_4$; **FA 8** is $(NH4)_2Fe(SO4)_2$; **FA 9** is $CrK(SO_4)_2$; **FA 10** is $MnSO_4$; **FA 11** is $NaNO_2$	
3(a)	Selects NaOH and NH_3	1
	Single table to show results with both NaOH and NH_3. No repeat headings. At least two of the **FA**s tested	1

	FA 7	FA 8	FA 9	FA 10	
NaOH	white ppt	green ppt	grey-green ppt	off-white/ pale brown/ buff ppt	1
excess	soluble	insoluble	soluble	insoluble	1
NH_3	white ppt	green ppt	grey-green ppt	off-white/ pale brown/ buff ppt	1
excess	soluble	insoluble	insoluble	insoluble	1

FA 8 ppt turning brown in air with either NaOH or NH_3	1
FA 9 ppt dissolves to form (dark) green solution with excess NaOH	1
FA 10 darkens/goes brown with either NaOH or NH_3	1

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Question	Answer	Marks
	<table><tr><th>FA 7</th><th>FA 8</th><th>FA 9</th><th>FA 10</th></tr><tr><td>Zn^{2+}</td><td>Fe^{2+}</td><td>Cr^{3+}</td><td>Mn^{2+}</td></tr></table> Award 1 mark for 2 correct ions. Award 2 marks for all 4 correct.	 1 1 **11**
3(b)	(dark) brown ppt/solid/suspension/deposit **and** effervescence/bubbling/fizzing positive test for oxygen – (gas/ O_2) relights glowing splint	1 1 **2**
3(c)(i)	blue solution **and** effervescence/bubbling/fizzing **or** brown fumes/gas	1
3(c)(ii)	NO_2^- **or** nitrite from either blue solution or brown gas	1

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Question	Answer	Marks
3(c)(iii)	selects NaOH and A*l* (for nitrite or nitrate) **or** selects (acidified) potassium manganate(VII)/ potassium permangate/ $KMnO_4$ If carbonate in **(ii)** (from bubbling without brown gas in **(i)**) then allow use of limewater to test gas If halide from no reaction then allow use of $AgNO_3$ **and** NH_3 If sulfate/sulfite from no reaction then allow use of $BaCl_2$/$Ba(NO_3)_2$ **and** HC*l*/HNO_3 Warming (with NaOH and A*l*) **and** gas/ammonia turns (damp red) litmus (paper) blue **or** Decolourises MnO_4^-	1 1 **4**
	Total:	**17**

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