

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the October/November 2014 series

9701 CHEMISTRY

9701/35

Paper 3 (Advanced Practical Skills 1),
maximum raw mark 40

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Question	Indicative material	Mark	Total
1 (a)	I Initial and final readings and titre value given for rough titre and initial and final readings for two (or more) accurate titrations (<i>minimum of 2 × 2 box</i>)	1	
	II Appropriate headings and units for accurate titration and volume FA 2 added recorded for each accurate titre. Headings should match readings. <ul style="list-style-type: none"> • initial / start (burette) reading / volume (not V or vol) • final / end (burette) reading / volume • titre or volume / FA 2 and used / added (<i>but not “difference”</i>) unit: / cm³ or (cm³) or in cm³ or cm³ for each entry 	1	
	III All accurate burette readings recorded to 0.05 cm ³ . <i>The need to record to 0.05 applies only to the burette readings and not to the recorded titres.</i> <i>Do not award this mark if:</i> <ul style="list-style-type: none"> • 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 Has two uncorrected, accurate titres within 0.1 cm ³ <i>Do not consider the ‘rough’ even if ticked.</i> <i>Do not award this mark if having performed two titres within 0.10 cm³ a further titration is performed which is more than 0.10 cm³ from the closer of the initial two titres, unless a further titration, within 0.10 cm³ of any other titration has also been carried out.</i> <i>Do not award the mark if any ‘accurate’ burette readings (apart from initial 0) are given to zero dp.</i> Round any burette readings to the nearest 0.05 cm ³ . Check and correct subtractions for Supervisor and candidate. Examiner then selects the “best” titre using the hierarchy: two (or more) identical; then two (or more) within 0.05 cm ³ ; then two (or more) within 0.1 cm ³ ; etc. Examiner compares candidate mean titre with Supervisor mean titre.	1	
	V, VI and VII Award V, VI and VII for a difference from Supervisor, $\delta \leq 0.20 \text{ cm}^3$ Award V and VI for $0.20 \text{ cm}^3 < \delta \leq 0.40 \text{ cm}^3$ Award V only for a difference of $0.40 < \delta \leq 0.60 \text{ cm}^3$ Spread penalty: if the ‘best’ titres are $> 0.50 \text{ cm}^3$ apart cancel one of the Q marks.	3	
			[7]

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<p>(b)</p>	<p>Calculation of mean</p> <ul style="list-style-type: none"> • Candidate must average two (or more) titres where the total spread is $<0.20 \text{ cm}^3$. • 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, and be correctly rounded to the nearest 0.01 cm^3. <p><i>Two special cases where the mean may not be to 2 dp:</i></p> <ul style="list-style-type: none"> • 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 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. <p><i>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.</i></p>	1	[1]
<p>(c) (i)</p> <p>(ii)</p> <p>(iii) and (iv)</p> <p>(v)</p>	<p>Correct working shown $\frac{0.110 \times \text{mean titre}}{1000}$ in step (i)</p> <p>Balanced equation with added state symbols</p> $\text{Na}_2\text{CO}_3(\text{aq}) + 2\text{HNO}_3(\text{aq}) \rightarrow 2\text{NaNO}_3(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$ <p>Correctly calculates</p> $\text{moles Na}_2\text{CO}_3 \text{ (in } 25 \text{ cm}^3) = \frac{1}{2} \times \text{(i)}$ <p>and</p> $\text{moles Na}_2\text{CO}_3 \text{ (in } 250 \text{ cm}^3) = 10 \times \text{(iii)}$ <p>Correctly calculates $M_r = \frac{150.0}{4 \times \text{(iv)} \times 10}$ or $(3.75 / \text{(iv)})$</p> <p><i>Theoretical answer = 286</i></p>	1	1

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(iii)	<p>Correct expression: $\Delta H = - \frac{(i)}{(ii) \times 1000}$</p> <p><i>Negative sign must be shown in answer. Answer must be expressed to 2–4 sf</i></p>	1	[3]
(c) and (a)	<p>All four thermometer readings shown to .0 °C or .5 °C</p> <p>Examiner calculates difference between (corrected) candidate's and Supervisor's temperature fall, δ.</p> <p>If $\delta < 2.0$ °C award one mark. If ΔT is < 9.5 °C only award if $\delta < 1.5$ °C. If ΔT is < 6.5 °C only award if $\delta < 1.0$ °C. If ΔT is < 3.5 °C only award if $\delta < 0.5$ °C.</p>	1 1	[2]
(d) (i) and (iii)	<p>Correct expressions Energy absorbed = $25 \times 4.2 \times \text{temp fall}$ and $\Delta H = + \frac{(i)}{(ii) \times 1000}$ (<i>sign needed in final answer</i>)</p>	1	
(ii)	<p>Correct expression for number of moles</p> <p>No. of moles = $\frac{\text{mass of FA 5}}{M_r}$ where $M_r = 106 + 18x$ (x is candidate's own value, or 8)</p>	1	[2]
(e)	<p>Attempt at use of Hess's law, either by cycle or reverse reaction 2</p> <p>Correctly calculates $\Delta H_{(\text{dehydration})}$ $\Delta H = (d)(iii) - (b)(iii)$</p>	1 1	[2]

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(f)	<p>Accept one of the following answers</p> <ul style="list-style-type: none"> • Agree – acid spray is reduced (since reaction will be slower)/ smaller T rise so less heat loss/larger volume so volume measurement more accurate • Disagree – smaller temperature change, so higher (percentage) error of reading / reaction slower so more heat loss. 	1	[1]
[Total: 13]			
FA 7 is $Al_2(SO_4)_3 + NaCl$; FA 8 is $MgCO_3 + KI$; FA 9 is $(NH_4)_2Fe(SO_4)_2$			
3 (a) (i)	<p>Both observations with HNO_3 recorded correctly FA 7 no reaction / no change / dissolves FA 8 fizzing or (gas) turns limewater milky</p>	1	
(ii) or (iii)	<p>FA 7 + $NaOH$: white ppt, soluble in excess or FA 7 + NH_3: (faint) white ppt, insoluble in excess</p>	1	
(iv)	<p>FA 7 + $Ba(NO_3)_2$: white ppt (insoluble in acid) and FA 8 + $Ba(NO_3)_2$: no ppt / no change / no reaction</p>	1	
(v)	<p>FA 7 + $AgNO_3$: white ppt, soluble in ammonia and FA 8 + $AgNO_3$: yellow ppt, insoluble in NH_3 <i>All four correct observations required.</i></p>	1	

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(vi)	<u>cation</u> cation is aluminium / Al^{3+} and white ppt with NH_3 insoluble in excess <u>anions</u> FA 7 anions: sulfate and chloride / SO_4^{2-} and Cl^- FA 8 anions: carbonate and iodide / CO_3^{2-} and I^- All four identities correct = 2 marks Any 2 or 3 identities correct = 1 mark	1	
		1 1	[7]
(b) (i)	Any two observations correct = 1 mark Any three (or more) correct = 2 marks <ul style="list-style-type: none"> • FA 9 is (pale) green • steam / vapour / condensation / water / liquid • litmus turns blue • yellow / white / brown residue/ formed • white smoke (produced on strong heating) • litmus turns red on strong heating 	2	
	(ii) Uses NaOH as reagent	1	
	With NaOH or NH_3 (dark / dirty) green ppt formed and Fe^{2+} identified. With NaOH and heat gas / ammonia turns litmus blue and NH_4^+ identified	1 1	[5]
[Total: 12]			