

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the May/June 2015 series**9701 CHEMISTRY****9701/35**Paper 3 (Advanced Practical Skills 1),
maximum raw mark 40

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Question	Indicative material	Mark	
1 (a)	<p>I The following data must be shown</p> <ul style="list-style-type: none"> burette readings and titre for rough titration 2 × 2 “box” showing both accurate burette readings 	1	
	<p>II Headings and units correct for accurate titration table and headings match readings.</p> <ul style="list-style-type: none"> initial/start (burette) reading/volume + unit final/end (burette) reading/volume + unit titre or volume/FA 3 used/added (<i>not “difference” or “total”</i>) + unit <p><i>Units: (cm³) or/cm³ or in cm³ or cm³ by every entry</i></p>	1	
	<p>III All accurate burette readings recorded to 0.05 cm³ <i>Do not award this mark if: 50(.00) is used as an initial burette reading or more than one final burette reading is 50.(00) or any burette reading is greater than 50.(00).</i></p>	1	
	<p>IV Two accurate titres are within 0.10 cm³. <i>Do not award if 3rd titre > 0.10 cm³ away from either previous titre unless a further titration is also carried out which is within 0.1 cm³ of any other. Do not award the mark if any ‘accurate’ burette reading (apart from an initial 0) are given to zero dp.</i></p>	1	
<p><i>Examiner checks and corrects titre subtractions where necessary. Examiner selects the best mean titre using a hierarchy: two identical titres within 0.05 cm³, two or more titres within 0.10 cm³ etc. Examiner subtracts (corrected) candidate’s titre from Supervisor’s titre.</i></p>			
	<p>Award V, VI and VII if $\delta < 0.20 \text{ cm}^3$ Award V and VI if $0.20 < \delta < 0.40 \text{ cm}^3$ Award V if $0.40 < \delta < 0.60 \text{ cm}^3$ <i>Spread penalty: if the two ‘best’ titres are $\geq 0.50 \text{ cm}^3$ apart, cancel one of the Q marks</i></p>	1 1 1	[7]
(b)	<p>Candidate must average two (or more) titres that are all within 0.20 cm³. Working must be shown or ticks must be put next to the two (or more) accurate readings selected.</p> <p>The mean should normally be quoted to 2 dp rounded to the nearest 0.01. Example: 26.667 must be rounded to 26.67.</p> <p>Two special cases where the mean may not be to 2 dp: allow mean to 3 dp only for 0.025 or 0.075 eg 26.325; allow mean to 1 dp if all accurate burette readings were given to 1 dp and the mean is exactly correct. eg 26.0 and 26.2 = 26.1 is correct but 26.0 and 26.1 = 26.1 is incorrect. 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.</p>	1	[1]

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Question	Indicative material	Mark	
(c)(i)(ii)	Correctly calculates Concentration = $0.1 \times 0.900 = 0.09(00)$ and No. of moles = (i) \times (b) _{/1000}	1	
(iii)(iv)	Correctly calculates No. of moles of I ₂ = $0.5 \times$ (ii) and Concentration of I ₂ = (iii) \times 1000 _{/25}	1	
(v)	Equation correctly balanced $2\text{Fe}^{3+} + 2\text{I}^- \rightarrow 2\text{Fe}^{2+} + \text{I}_2$ and use of 2:1 mole ratio: answer to (v) = $2 \times$ (iv)	1	
(vi)	Two steps are required: <ul style="list-style-type: none"> $M_r = 38.56$ / (v) Mass of water = $M_r - (55.8 + 18 + [2 \times 96.1])$ or $M_r - 266$ 	1	[6]
	Correctly calculates x from mass of water moles of water = $\frac{\text{mass}}{18}$ and answer expressed to nearest integer	1	
	Final answers to (i) – (v) shown to 2 – 4 sf (minimum 4 steps attempted)	1	
[Total: 14]			
2 (a)	Initial and highest thermometer readings shown and temperature rise correctly calculated with unambiguous headings and correctly displayed units.	1	
<i>Examiner to calculate Supervisor's and candidate's ΔT. Calculate the difference between the two values.</i>			
	III and IV awarded dependant on comparability between Supervisor's and candidate's ΔT values.	1 1	[3]
(b)(i)(ii)	Correctly calculates energy produced = $25 \times 4.2 \times \Delta T$ (a) and moles of FA 6 = 0.5×25 / 1000 (= 0.0125) and both answers to a minimum of 2 sf	1	
(iii)	Correct expression $\Delta H =$ (i) / 1000 \times (ii)	1	[2]
(c)	Precision of readings shown in (a) and (c): all four thermometer readings shown to 0.0 or 0.5 °C	1	
<i>Examiner to calculate Supervisor's and candidate's ΔT. Calculate the difference between the two values.</i>			

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	Marks awarded dependant on comparability between Supervisor's and candidate's ΔT values.	1	[2]
(d)(i)(ii)	Correct expressions energy produced = $25 \times 4.2 \times \Delta T(\mathbf{c})$ and $\Delta H = (\mathbf{d)(i)} / 1000 \times (\mathbf{b)(ii)}$	1	
	Correct (negative) sign shown in answers to (b)(iii) and (d)(ii) and both answers shown to 2 – 4 sf	1	[2]
(e)	Hess' Law cycle drawn to show <ul style="list-style-type: none"> displacement equation across top left hand downward arrow, labelled (b)(iii) or calculated value right hand downward arrow, labelled (d)(ii) or calculated value or allow from clear use of equations: Fe equation reversed and added to Zn equation or arrows showing correct directions	1	
	Correctly calculates (b)(iii) – (d)(ii) , with correct sign.	1	[2]
(f)(i)	Correctly calculates: max % error = $(2 \times 0.5 / \Delta T(\mathbf{e})) \times 100$	1	
(ii)	One of the following: <ul style="list-style-type: none"> use a more concentrated solution of copper(II) sulfate (and larger quantities of metals) use a lid with hole for thermometer or another specific suggestion to improve insulation plot a cooling curve use a larger volume / use a burette / pipette to reduce percentage error in volume use a pipette / burette instead of a measuring cylinder 	1	[2]
[Total: 13]			

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FA 7 = Na ₂ S ₂ O ₃ (s); FA 8 = Zn(NO ₃) ₂ (aq); FA 9 = BaCl ₂ (aq)			
3	(a)(i)	Any two observations from the following: <ul style="list-style-type: none"> • solid melts / dissolves or changes to liquid / solution • condensation (inside tube) or steam / water vapour / water / steamy fumes (not white fumes) • effervescence • (blue) litmus turns red • (dark) brown residue obtained or yellow solid • bad egg smell 	1
	(ii)	White / off-white / cream / yellow ppt / solid obtained (<i>in either part of (ii)</i>)	1
		Gas turns potassium manganate(VII) to colourless	1
	(iii)	Any two observations from the following: <ul style="list-style-type: none"> • brown / yellow-brown / green-brown (mixture / precipitate) obtained (at first) • changes to white / off-white (ppt) (when FA 1 added) • (colourless) solution formed / ppt / solid soluble (with excess FA 1) 	1
	(iv)	Equation concludes with: + S + SO ₂	1 [5]
(b) test		observations	
		FA 8	FA 9
(i)	+ NaOH	white ppt soluble in excess [1]	
(ii)	+ AgNO ₃ then NH ₃		white ppt soluble [1]
(iii)	+ NH ₃	white ppt soluble in excess [1]	
(iv)	+ H ₂ SO ₄	no change / no reaction / no ppt (not clear solution)	white ppt [1]
(v)	+ FA 9	no change / no reaction / no ppt (not clear solution) [1]	

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3	(b)(vi)	3 identifications correct = two marks Any 2 identifications correct = one mark FA 8: cation is Zn^{2+} / zinc; anion is unknown FA 9: cation is Ba^{2+} / barium; anion is Cl^{-} / chloride	1 1	
	(vii)	unknown ion = NO_3^{-} reagent(s) = NaOH and Al/Zn (and warm) observation(s) = (gas) turns red litmus blue or ammonia produced	1	[8]
				[Total: 13]