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.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2015 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

CAMBRIDGE
International Examinations

Question	Indicative material	Mark	
1 (a)	**I** The following data must be shown • burette readings **and** titre for rough titration • 2 × 2 "box" showing both accurate burette readings	1	
	II Headings and units correct for accurate titration table and headings match readings. • initial / start (burette) reading / volume + unit • final / end (burette) reading / volume + unit • titre ***or*** volume / **FA 3** used / added *(not "difference" or "total")* + unit *Units: (cm^3) or / cm^3 or in cm^3 or cm^3 by every entry*	1	
	III All accurate burette readings recorded to 0.05 cm^3 *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).*	1	
	IV Two accurate titres are within 0.10 cm^3. *Do **not** award if 3rd titre > 0.10 cm^3 away from either previous titre unless a further titration is also carried out which is within 0.1 cm^3 of any other.* *Do **not** award the mark if any 'accurate' burette reading (apart from an initial 0) are given to **zero** dp.*	1	
Examiner checks and corrects titre subtractions where necessary. Examiner selects the best mean titre using a hierarchy: *two identical titres within 0.05 cm^3, two or more titres within 0.10 cm^3 etc.* *Examiner subtracts (corrected) candidate's titre from Supervisor's titre.*			
	Award **V**, **VI** and **VII** if $\delta < 0.20$ cm^3 Award **V** and **VI** if $0.20 < \delta < 0.40$ cm^3 Award **V** if $0.40 < \delta < 0.60$ cm^3 *Spread penalty: if the two 'best' titres are ⩾ 0.50 cm^3 apart, cancel one of the Q marks*	1 1 1	[7]
(b)	Candidate must average two (or more) titres that are all within 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. Example: 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 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.	1	[1]

Question	Indicative material	Mark	
(c)(i)(ii)	Correctly calculates Concentration = 0.1 × 0.900 = 0.09(00) **and** No. of moles = **(i)** × $^{\textbf{(b)}}/_{1000}$	1	
(iii)(iv)	Correctly calculates No. of moles of I_2 = 0.5 × **(ii)** **and** Concentration of I_2 = **(iii)** × $^{1000}/_{25}$	1	
(v)	Equation correctly balanced $2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2$ **and** use of 2:1 mole ratio: answer to **(v)** = 2 × **(iv)**	1	
(vi)	Two steps are required: • $M_r = {}^{38.56}/_{\textbf{(v)}}$ • Mass of water = M_r – (55.8 + 18 + [2 × 96.1]) **or** M_r – 266	1	
	Correctly calculates ***x*** from mass of water moles of water = $^{\text{mass}}/_{18}$ **and** answer expressed to nearest integer	1	
	Final answers to **(i)** – **(v)** shown to 2 – 4 sf (*minimum 4 steps attempted*)	1	[6]
			[Total: 14]
2 (a)	Initial and highest thermometer readings shown **and** temperature rise correctly calculated with unambiguous headings and correctly displayed units.	1	
Examiner to calculate Supervisor's and candidate's ΔT. *Calculate the difference between the two values.*			
	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 × 4.2 × ΔT**(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 ΔH = **(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 ºC	1	
Examiner to calculate Supervisor's and candidate's ΔT. *Calculate the difference between the two values.*			

	Marks awarded dependant on comparability between Supervisor's and candidate's ΔT values.	1	[2]
(d)(i)(ii)	Correct expressions energy produced = $25 \times 4.2 \times \Delta T$ **(c)** **and** ΔH = **(d)(i)** / $_{1000 \times \textbf{(b)(ii)}}$	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 • 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 = $(^{2 \times 0.5}/_{\Delta T\textbf{(c)}}) \times 100$	1	
(ii)	**One** of the following: • 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]

FA 7 = $Na_2S_2O_3(s)$; **FA 8** = $Zn(NO_3)_2(aq)$; **FA 9** = $BaCl_2(aq)$

3 (a)(i)	Any **two** observations from the following: • 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 (*in either part of **(ii)***)	1	
	Gas turns potassium manganate(VII) to colourless	1	
(iii)	Any **two** observations from the following: • 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_2SO_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]	

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]