UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2011 question paper for the guidance of teachers

9701 CHEMISTRY

9701/34 Paper 3 (Advanced Practical Skills 2), 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 must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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Question	Sections	Indicative material	Mark	
1 (a)	MMO Collection PDO Collection ACE Interpretation	**I** Performs experiment and records **all** sensible thermometer readings. **II** Records all thermometer readings to 0.0/0.5 °C. **III** Correctly calculates the temperature rises.	1 1 1	
	MMO Quality	Award **IV**, **V** and **VI** for a ΔT within 0.5 °C of Supervisor's result. Award **IV** and **V** for a ΔT within 1.0 °C of Supervisor's result. Award **IV** only for a ΔT within 1.5 °C of Supervisor's result.	3	
	Calculate result for 35 cm^3 by multiplying candidate's result for 30 cm^3 of **FB 1** by 0.75, round up to the nearest 0.5 ºC.			
		Award **VII** and **VIII** if candidate's temperature rise for 35 cm^3 **FB 1** is within 0.5 °C of calculated value. Award **VII** only if ΔT is within 1.0 °C	2	[8]
(b)	PDO Display	**I** Axes labelled: temperature/T change or ΔT and volume/Vol/V sodium hydroxide/NaOH **and** correct units /°C or (°C) or 'in °C', /cm^3 or (cm^3). **II** Suitable scales chosen so that the points, if plotted, would occupy at least half the available length for *x*- and *y*-axes. *Do not award if 50 cm^3 not included*. **III** Plotting – accurate to within half a small square and in the correct square. **IV** Draws two straight lines of best fit which intersect. *Allow coming to a point (**not** curved). Does not have to go through (0,0).*	1 1 1 1	[4]

(c)	ACE Interpretation	**(i)** **I** Reads to nearest ½ square temperature rise to 1 dp at point of intersection. Do not award if intersection < largest ΔT.	1	
		(ii) **II** Reads to nearest ½ square volume of **FB 1** to 1 dp or nearest 0.5 cm^3 at point of intersection.	1	
		(iii) **III** Correctly calculates moles of sodium hydroxide [volume of **FB 1** in **(ii)** × 1.5/1000] to 2 to 4 sf.	1	
		(iv) **IV** Heat energy produced = 50 × 4.3 × temperature rise from **(i)**	1	
		V Correct answer calculated to 3 or 4 sf. *ecf from incorrect* ***volume***	1	
		(v) **VI** $\frac{\text{candidate's answer to (iv)}}{\text{candidate's answer to (iii)}}$	1 1	
		VII Negative sign and answer in kJ to 2 to 4 sf	1	[7]
(d)	ACE Interpretation	Identifies a source of error e.g. precision of thermometer, precision of measuring cylinder*	1	
	ACE Improvements	Suggests thermometer with smaller scale divisions (0.1°C), use of burette*	1	[2]
(e)	ACE Interpretation	**(i)** **I** Calculates or expression for the volume of **FB 2** which reacts [50 – **(c)(ii)**].	1	
		II Correctly calculates the concentration of H^+ in mol dm^{-3} (≥ 2 sf) [**(c)(iii)** × 1000/{50 – **(c)(ii)**}].	1	
	PDO Display	**(ii)** **III** Divides the answer from **(i)** by 2	1	
	Decisions	**(iii)** **IV** Describes test and result for sulfate ion. White ppt with (aq) barium chloride or nitrate	1	[4]
				[Total: 25]

* e.g.	1st mark	2nd mark
	use more sensitive thermometer	0.5, 0,2, 0.1ºC or smaller % error
	smaller divisions in measuring cylinder	burette or decrease % error
	use burette as more accurate	
	cup has little water, use dry cup	
	10 cm^3 too small to take T, start with 20 cm^3	

	FB 3 is $Na_2CO_3(aq)$; **FB 4** is $Na_2CrO_4(aq)$; **FB 5** is NaBr; **FB 6** is MnO_2					
2	**(a)**	PDO Recording MMO Collection	**(i)**	**I**	All observations in a single table (2 × 3) No repeat of headings & ≥ 4 boxes filled. Observations for **both** tests on each solution are correct.	1
				II	**FB 3**	1
				III	**FB 4**	1
				IV	**FB 5**	1

Solution	H_2SO_4	$Pb(NO_3)_2$
FB 3	bubbling/effervescence **and** CO_2 identified by test (allow **gas** turns limewater milky)	white ppt
FB 4	turns orange/orange (solution) forms (**not** ppt but not CON for identity)	yellow ppt
FB 5	no change/no reaction [not " – "]	white ppt

	ACE Conclusions			**V**	**FB 3** carbonate/CO_3^{2-} from effervescence **or** positive limewater test	1
				VI	**FB 4** chromate(VI)/chromate/CrO_4^{2-} from either observation but no CON obs	1 [6]
	MMO Decisions Collection	**(ii)**	**I**		Addition of (aq) silver nitrate to **FB 5**. ***ecf*** *on obs in table if no ppt with* ***FB 5*** *+* Pb^{2+}	1
			II		**Cream** ppt (white ppt loses **II** and **III**) If NH_3 used obs must be correct.	1
	ACE Conclusions		**III**		**FB 5** bromide/Br^- from cream ppt (or off-white ppt insol or partially soluble in NH_3)	1 [3]
	(b)	MMO Collection	**(i)**	**I**	(bubbling/effervescence and) gas rekindles glowing splint	1
			(ii)	**II**	filtrate is yellow/qualified yellow/yellowish green/light brown **and** produces a red-brown/brown/rust/black (not red) ppt with aqueous sodium hydroxide	1
			(iii)	**III**	filtrate is green/qualified green	1
				IV	filtrate turns purple/pink (with acid)	1
		ACE Conclusions		**V**	**(i)** **FB 6** is a catalyst *Allow* O_2 *formed or* H_2O_2 *decomposes* ***if*** *glowing splint test correct.*	1
				VI	**(ii)** **FB 6** is an oxidant/oxidising agent/is reduced.	1 [6]
						[Total: 15]