CAMBRIDGE INTERNATIONAL EXAMINATIONS
GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2013 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.

Page 2	Mark Scheme	Syllabus	Paper
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Question	Sections	Indicative material	Mark	Total
1 (a)	MMO Collection	**I** All thermometer readings recorded **and** two weighings + correct mass of **FA 1** recorded.	1	
	PDO Recording	**II** Correct headings and units in **both** tables in **(a)** (Mass) and **(c)** (Mass and temperature). *Must use solidus, brackets or describe unit fully in words. If units not included in column headings every entry must have the correct unit shown.*	1	
		III Temperature recorded to 0.5 °C *(must have at least one at 0.5 °C and one to 0.0 °C)* and weighings to same number of dp (on page 2).	1	
		Examiner to calculate Supervisor – candidate $\Delta T/m$ *(ΔT from table)*.		
	MMO Quality	Award **IV** and **V** if $\delta \leq 0.20$ °C g^{-1} Award **IV** if $0.20 < \delta \leq 0.50$ °C g^{-1}	1 1	[5]
(b)	PDO Layout	**I** Uniform scales chosen to use more than half of each axis. Axes labelled, ignore units.	1	
		II All points correctly plotted within ½ small square and in correct small square on *y*-axis and on the line on *x*-axis.	1	
		III Appropriate lines of best fit are drawn.	1	
	ACE Interpretation	**IV** Correct value of ΔT (or to nearest 0.5 °C) from extrapolated lines (ignore sf).	1	[4]
(c)	PDO Recording	**I** Table drawn to include weighings, correct mass of **FA 2**, initial and final thermometer readings.	1	
		Examiner to calculate Supervisor – candidate ΔT		
	MMO Quality	Award **II** and **III** if $\delta \leq 0.5$ °C Award **II** only if $0.5 < \delta \leq 1.0$ °C	1 1	[3]

(d) (i) **& (iii)**	ACE Interpretation	**I**	Correctly calculates 25 x 4.3 $\times \Delta T$ for step 1 **and** for step 2.	1	
(ii)		**II**	Correctly calculates $\frac{answer\ to\ (i)\ x\ 120.4}{mass\ FA\ 1\ x\ 1000}$ (if number of moles calculated, value used must be to at least 2 sf).	1	
(iv)		**III**	Correctly calculates $\frac{answer\ to\ (iii)\ x\ 246.4}{mass\ FA\ 2\ x\ 1000}$ (do not penalise incorrect sign a second time).	1	
(v)		**IV**	Correctly calculates ΔH from answers to **(ii)** and **(iv)** with correct sign (**(ii)** – **(iv)**) (allow ecf for sign)	1	
	PDO Display	**V**	Working in the right direction shown in parts **(i)** – **(iv)**. **(i)** and **(iii)** use of $mc\Delta T$; **(ii)** use of 120.4; **(iv)** use of 246.4	1	
		VI	All final answers given to 3 or 4 sf (minimum of 3 answers).	1	[6]
1 (e) (i)	ACE Interpretation		Single thermometer reading ± 0.5°C (or ±0.1°C if candidate recorded T to 0.1°C). ΔT ± 1.0°C (or ± 0.2°C)	1	
(ii)			Calculates {1.0/ΔT} $\times$ 100 (or {0.2/ΔT} $\times$ 100) for step 2 to 2 or more sf. Allow ecf.	1	[2]
(f) (i)	ACE Improvements		Student incorrect as smaller temp change or % error in temp change increased.	1	[1]
(ii)	MMO Interpretation		Calculates $\Delta T/m$ or $m/\Delta T$ or Q/m for **each** result. Allow mass of solid $\times\ c \times \Delta T$.	1	
	MMO Decisions		Yes, values concordant/consistent (shown:– $\Delta T/m$:1.2/1.20/1.198 and 1.2/1.20/1.196 or $m/\Delta T$: 0.84/0.835 and 0.84/0.836 or Q/m: 128.7 and 128.6 respectively).	1	[2]
					[Total: 23]

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<table>
<tr><td colspan="4" align="center">FA 3 is CrCl$_3$; FA 4 is $(NH_4)_2Fe(SO_4)_2$; FA 5 is $Pb(NO_3)_2$</td><td></td><td></td></tr>
<tr>
<td>2</td>
<td>(a)</td>
<td>MMO
Collection</td>
<td>FA 3 gives grey-green ppt soluble in NaOH/ giving dark green solution in excess and grey-green ppt insoluble in excess NH$_3$</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td><td></td><td></td>
<td>FA 4 gives green/dirty green ppt insoluble in excess of both and turning brown/darkening in at least one</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td><td></td><td></td>
<td>FA 5 gives white ppt soluble in excess NaOH and white ppt insoluble in excess NH$_3$
or
Award 1 mark if all NaOH observations, including in excess, are correct.
Award 1 mark if all NH$_3$ observations, including in excess, are correct.</td>
<td>1</td>
<td>[3]</td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>MMO
Decisions</td>
<td>Selects products with excess NaOH in (i) and warms the product in (ii).</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td><td></td><td></td>
<td>Tests gas/ammonia with (damp) red litmus and turns blue in (ii).
(Stand-alone mark irrespective of reagent chosen.)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td><td></td>
<td>MMO
Collection</td>
<td>FA 4 gives (gas) turning red litmus blue
Neither of the others give a positive result.</td>
<td>1
1</td>
<td>[4]</td>
</tr>
<tr>
<td></td>
<td>(c)</td>
<td>MMO
Decisions</td>
<td>I Selects any 2 from:
AgNO$_3$, BaCl$_2$ or Ba(NO$_3$)$_2$, Pb(NO$_3$)$_2$
(full reagent names or formulae needed)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td><td></td><td></td>
<td>II NaOH + Al and warm
do not penalise OH$^-$ + Al and warm if full names not given above</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td><td></td>
<td>MMO
Collection</td>
<td>III and IV   Any 2 of:
only FA 3 gives (white) ppt with Ag$^+$;
only FA 4 gives white ppt with Ba^{2+} (allow off-white);
FA 3 and FA 4 give white ppt with Pb^{2+}</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td><td></td><td></td>
<td>V FA 5 and FA 4   (if tested) form gas/ammonia on warming (or warm in reagent column) which turns (damp) red litmus paper blue</td>
<td>1</td>
<td>[5]</td>
</tr>
</table>

Page 5		Mark Scheme		Syllabus	Paper
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(d)	ACE Conclusions	**I FA 3** contains Cr^{3+} and Cl^-	1	
		II FA 4 contains Fe^{2+} and SO_4^{2-}	1	
		III Only **FA 4** contains NH_4^+	1	
		IV FA 5 contains either Pb^{2+} or Al^{3+} (**both** given)	1	
		V Only **FA 5** contains NO_3^-	1	[5]
				[Total: 17]