Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CHEMISTRY **9701/33**

Paper 3 Advanced Practical Skills 1 **October/November 2018**

MARK SCHEME

Maximum Mark: 40

Published

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 International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Rounding errors and transcription errors are penalised only once in the paper.

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td rowspan="4">1(a)</td><td>I Headings and units correct
Balance readings recorded to same dp (to at least 1 dp)
Mass of Mg correctly calculated
• Mass of container + FA 2 / Mg (not weight)
• Mass of container (+ residue/empty)
• Mass of FA 2 / Mg
Units: (g), / g, in g, in grams / grammes (not gm) or g by each entry</td><td>1</td></tr>
<tr><td>II Thermometer readings to ± 0.5 °C (at least one ending in .5 and one at .0)
(Minimum 12 readings)</td><td>1</td></tr>
<tr><td>Examiner corrects thermometer readings to the nearest 0.5 °C
Examiner calculates max ΔT from table for supervisor and candidate
ΔT = max T – T at 2 min. Examiner calculates the difference, δ, from candidate.</td><td></td></tr>
<tr><td>Award III and IV according to the table below</td><td>2</td></tr>
<tr><td colspan="2">
<table>
<tr><td>Sup ΔT_{max}</td><td>>50.0 °C</td><td>40.5–50.0 °C</td><td>30.5–40.0 °C</td><td>20.5–30.0 °C</td><td>10.5-20.0 °C</td><td><10.0 °C</td></tr>
<tr><td>1 mark</td><td>$\delta \leqslant$ 7.5 °C</td><td>$\delta \leqslant$ 6.0 °C</td><td>$\delta \leqslant$ 4.5 °C</td><td>$\delta \leqslant$ 3.0 °C</td><td>$\delta \leqslant$ 2.0 °C</td><td>$\delta \leqslant$ 1.0 °C</td></tr>
<tr><td>2 marks</td><td>$\delta \leqslant$ 5.0 °C</td><td>$\delta \leqslant$ 4.0 °C</td><td>$\delta \leqslant$ 3.0 °C</td><td>$\delta \leqslant$ 2.0 °C</td><td>$\delta \leqslant$ 1.0 °C</td><td>not available</td></tr>
</table>
</td><td></td></tr>
</table>

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Question	Answer	Marks
1(b)(i)	**I** Axes labelled, linear scales chosen so that more than half the available space is used on both axes for plotted points and 10 °C above highest *T*	**1**
	II All points recorded are correctly plotted Points plotted to within half a small square and in the correct square for *y*-axis and (normally) on line for *x*-axis.	**1**
	III Two best-fit lines (straight or smooth curve) drawn before adding Mg and after solution starts cooling or temperature remains constant (for a minimum of 3 points). (Best fit: points must be balanced either side of the line.)	**1**
1(b)(ii)	Correctly extrapolated (best fit) lines drawn up to time 2½ minutes and after 2½ minutes and vertical line drawn at 2½ minutes.	**1**
	ΔT read correctly from graph to within half a small square.	**1**
1(c)(i)	**Correctly calculates** $(^{151.9}/_{159.6})$ = 0.952 / 0.9518 mol dm^{-3} (3 or 4 sf only)	**1**
1(c)(ii)	**Correctly uses** n($CuSO_4$) = $^{\textbf{(c)(i)}}/_{40}$ = 0.024 / 0.0238 / 0.02379 **and** answer to 2–4 sf Allow ecf	**1**
1(c)(iii)	**Correctly calculates** 25 × 4.2 × **(b)(ii) and** answer to 2–4 sf	**1**
1(c)(iv)	**Correctly uses** $\frac{\textbf{(iii)}}{\textbf{(ii)} \times 1000}$ **and** answer to 2–4 sf (Ignore sign here for this mark.) Infer use of 1000 from answer. Allow ecf	**1**
1(c)(v)	**Correctly calculates** moles(Mg) = $^{\text{mass(Mg)}}/_{24.3}$ **and** states answer > 0.024 / 0.0238 *ora* (Allow ecf for value of moles of $CuSO_4$ in **(c)(ii)**.)	**1**

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Question	Answer	Marks
1(d)(i)	No – **slower** so might not finish within 8 minutes / maximum temperature rise does not occur within 8 minutes / temperature may not fall within 8 minutes No – **cooling curve used** **and** to eliminate heat losses / ΔT not affected	**1**
1(d)(ii)	Any **one** of Use lid **to reduce heat loss** Use burette / pipette to measure volume of **FA 1** as **more accurately calibrated/smaller percentage error** Use thermometer with smaller calibrations to **reduce percentage error**	**1**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td rowspan="4">2(a)</td><td>I Data tabulated / listed with unambiguous headings
(Ignore units unless word ‘mass’ or ‘temperature’ missing)
• 2 balance readings
• 2 thermometer readings
• mass Zn correctly calculated and between 1.80 and 2.00 g
• ΔT correctly calculated
(Not ‘weight’, not ‘amount’)</td><td>1</td></tr>
<tr><td>Examiner checks subtractions of supervisor and candidate. Examiner calculates the difference, δ, from candidate.</td><td></td></tr>
<tr><td>Award II and III according to the table below</td><td>2</td></tr>
<tr><td><table>
<tr><td>Sup ΔT</td><td>40.5–50.0 °C</td><td>30.5–40.0 °C</td><td>20.5–30.0 °C</td><td>10.5–20.0 °C</td><td><10.0 °C</td></tr>
<tr><td>1 mark</td><td>$\delta \leqslant$ 6.0 °C</td><td>$\delta \leqslant$ 4.5 °C</td><td>$\delta \leqslant$ 3.0 °C</td><td>$\delta \leqslant$ 2.0 °C</td><td>$\delta \leqslant$ 1.0 °C</td></tr>
<tr><td>2 marks</td><td>$\delta \leqslant$ 4.0 °C</td><td>$\delta \leqslant$ 3.0 °C</td><td>$\delta \leqslant$ 2.0 °C</td><td>$\delta \leqslant$ 1.0 °C</td><td>not available</td></tr>
</table></td><td></td></tr>
<tr><td rowspan="2">2(b)(i)</td><td>Correctly uses
$\Delta H = (-)\ \frac{25 \times 4.2 \times \Delta T}{\textbf{1(c)(ii)} \times 1000}$ and to minimum 2 sf</td><td>1</td></tr>
<tr><td>Appropriate signs shown in answers to both 1(c)(iv) and 2(b)(i)</td><td>1</td></tr>
<tr><td>2(b)(ii)</td><td>Correctly calculates
$(^{2 \times 0.5}/_{\Delta T}) \times 100$ and answer given to at least 2 sf</td><td>1</td></tr>
<tr><td>2(c)</td><td>Ticks temp rise would be the same and
double the volume but also double the moles / amount of $CuSO_4$ / FA 1 reacting (owtte or by calculation)</td><td>1</td></tr>
</table>

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Question	Answer	Marks
2(d)(i)	Attempt at use of Hess' law (Minimum: equation for reaction, correct direction of arrows and correct numbers shown)	**1**
	Correctly calculates **1(c)(iv) – 2(b)(i)** (Default answer = –119)	**1**

Question	Answer	Marks
	FA 4 is NH_4VO_3(aq); **FA 5** is H_2SO_4(aq)	
3(a)	+ KI **Solution** (turns) brown / red-brown / orange-brown / yellow-brown **or** black ppt / solid	**1**
	+ sodium thiosulfate (Solution) turns blue Allow blue-green / green solution; ignore 'cloudy' or 'milky'.	**1**
	+ Zn Expected **solution** colour changes: yellow → green → blue → green → violet 3 colours of solution correct (in the correct order) = 2 marks, 2 colours of solution correct (in the correct order) = 1 mark	**2**
	bubbles / effervescence/ fizzing **or** gas pops with lighted splint	**1**
3(b)(i)	Selects $BaCl_2$ / $Ba(NO_3)_2$ **and** for H_2SO_4 **and** $AgNO_3$ **and** for HCl	**1**
	Selects NaOH + Al **and** for HNO_3	**1**

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Question	Answer	Marks
3(b)(ii)	White ppt with Ba^{2+} / no reaction with any other **appropriate** anion tests listed in **(b)(i)**	**1**
	SO_4^{2-} / 'unknown' (from appropriate observation)	**1**
3(c)	+ $KMnO_4$ Expected colour changes of solution: violet / final colour given in **3(a)** → green → blue → green → yellow (*allow orange*) → pink / purple 3 colours correct (in the correct order) = 2 marks, 2 colours correct (in the correct order) = 1 mark	**2**
	+ **FA 4** Turns blue / green (ignore state)	**1**
3(d)(i)	Redox	**1**
	manganate(VII) / MnO_4^- (*allow $KMnO_4$*) is an oxidising agent / is reduced / changes from purple to colourless (*allow is decolourised*) **or** different colours indicate different oxidation states	**1**
3(d)(ii)	(+) 5	**1**

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