Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CHEMISTRY **9701/52**

Paper 5 Planning, Analysis and Evaluation **October/November 2019**

MARK SCHEME

Maximum Mark: 30

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 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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.

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.

Question	Answer	Marks
1(a)(i)	arrow pointing inwards at bottom condenser inlet	**1**
1(a)(ii)	Solution **A** / alkali must be added dropwise	**1**
1(a)(iii)	to prevent vapour loss / escape of vapour	**1**
1(a)(iv)	(incorrect) heating causes gases to expand **OR** Pressure would build up (causing apparatus to pop apart)	**1**
1(b)(i)	**M1:** Condenser **sloping** in the 'distillation' position able to accept distillate vapours **M2:** Condenser with (delivery) end open and rest of apparatus sealed	**2**
1(b)(ii)	CH_3CH_2OH **AND** lowest boiling point.	**1**
1(b)(iii)	**M1:** Cool (the solution) (until crystals form) **M2:** Filter **AND** rinse (the crystals) [with (cold) water].	**2**
1(c)	**M1:** mass obtained would be less **M2:** because of H_2O loss / formation / production	**2**
1(d)	**M1:** (only) CH_3I is a liquid at room temperature **M2:** (C—I) bond weakest / easiest to break	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(i)</td><td>mass = 0.100 × (10 × 12.0 + 8 × 1.0) = 12.8(0)</td><td>1</td></tr>
<tr><td>2(a)(ii)</td><td>
<table>
<tr><th>Mol</th><th colspan="3">Y</th><th>temp</th><th>$1/T_m$</th><th colspan="3">Log Y</th></tr>
<tr><td>0.00</td><td>1.00…</td><td>1.00</td><td>1.00</td><td>353</td><td>2.83</td><td>0.00</td><td>0.00</td><td>0.00</td></tr>
<tr><td>0.00888</td><td>0.91844…</td><td>0.918</td><td>0.92</td><td>349</td><td>2.87</td><td>-0.0369</td><td>-0.0372</td><td>-0.0362</td></tr>
<tr><td>0.0178</td><td>0.84889…</td><td>0.849</td><td>0.85</td><td>345</td><td>2.90</td><td>-0.0711</td><td>-0.0711</td><td>-0.0706</td></tr>
<tr><td>0.0266</td><td>0.78988…</td><td>0.790</td><td>0.79</td><td>341</td><td>2.93</td><td>-0.102</td><td>-0.102</td><td>-0.102</td></tr>
<tr><td>0.0355</td><td>0.73800…</td><td>0.738</td><td>0.74</td><td>338</td><td>2.96</td><td>-0.132</td><td>-0.132</td><td>-0.131</td></tr>
<tr><td>0.0444</td><td>0.69252…</td><td>0.693</td><td>0.69</td><td>334</td><td>2.99</td><td>-0.160</td><td>-0.159</td><td>-0.161</td></tr>
<tr><td>0.0533</td><td>0.65231…</td><td>0.652</td><td>0.65</td><td>331</td><td>3.02</td><td>-0.186</td><td>-0.186</td><td>-0.187</td></tr>
<tr><td>0.0621</td><td>0.61690…</td><td>0.617</td><td>0.62</td><td>329</td><td>3.04</td><td>-0.210</td><td>-0.210</td><td>-0.208</td></tr>
<tr><td>0.0769</td><td>0.56529…</td><td>0.565</td><td>0.57</td><td>325</td><td>3.08</td><td>-0.248</td><td>-0.248</td><td>-0.244</td></tr>
</table>

M1: for column 4, $(\frac{1}{T_m})$
M2: for column 5 (log *Y*)
M3: All values in columns 4 and 5 to 3 SF</td><td>3</td></tr>
<tr><td>2(b)</td><td>**M1:** nine points plotted correctly including 2.83, 0.00.
M2: best-fit **straight** line drawn</td><td>2</td></tr>
<tr><td>2(c)(i)</td><td>**M1:** coordinates read & recorded correctly
M2: gradient determined</td><td>2</td></tr>
</table>

Question	Answer	Marks
2(c)(ii)	$\frac{-\Delta H_{fusion}}{2.30 \times R}$ ΔH_{fusion} = (– **2(c)(i)** × 2.30 × 8.31) / 1000	**1**
2(d)(i)	Yes, (the data is reliable because) **AND** there are no anomalous points **OR** only 1, 2 or 3 anomalous points **OR** only a few points are not on/near the line **OR** most points on the line **OR** all the points are on the line **OR** No **AND** one or more anomalous points **OR** one or more points away from the line	**1**
2(d)(ii)	**M1:** *literature values:* lower limit = 1.45 ÷ (10.00/128.0) = 18.56 (kJ mol^{-1}) **AND** upper limit = 1.47 ÷ (10.00/128.0) = 18.82 / 18.816 (kJ mol^{-1}) **M2:** experiment is not (very) accurate because experimental ΔH_{fusion} is outside literature range	**2**
2(e)	**M1:** (on mixing) ΔH_1 would be more positive **M2:** ΔH_{mixing} is positive / >0 **OR** $\Delta H_1 = \Delta H_{fusion} + \Delta H_{mixing}$	**2**
2(f)(i)	Y is smaller **AND** because n_D is larger (and $Y = \frac{n_N}{n_N + n_D}$)	**1**

Question	Answer	Marks
2(f)(ii)	If Y is **smaller** in **2(f)(i)** **M1:** ΔH_{fusion} will be more positive (than actual value) **M2:** log *Y* is more negative **OR** Gradient is more negative If Y is **greater** in **2(f)(i)** **M1:** ΔH_{fusion} will be less positive (than actual value) **M2:** log *Y* is less negative **OR** Gradient is less negative	**2**