CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Level

MARK SCHEME for the October/November 2015 series

9701 CHEMISTRY

9701/51 Paper 5 (Planning, Analysis and Evaluation), maximum raw mark 30

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.

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CAMBRIDGE
International Examinations

Question	Expected Answer	Mark
1 (a)	PV = nRT	**[1]**
	M_r = mass / amount in mol **OR** M_r = m / n **OR** g / n **OR** any of these formulae correctly re-arranged	**[1]**
(b) (i)	volume (measured / recorded at 60 °C) is higher **OR** volume is lower at 50 °C / at lower temperature	
	(calculated) M_r is lower	**[3]**
(ii)	The volume would be reduced **OR** as P increases M_r increases **AND** answer closer to the true value / yes	**[1]**
(c)	Place water / oil / sand within the outer VM tube **AND** heat the outer tube	**[1]**
	Shows appropriate connections to collect the air over water / in syringe (any size) using the side tube	**[1]**
(d)	Hexane: • is (in)flammable / burns readily • causes irritation to the skin • causes breathing difficulties • forms explosive mixture (with air) **OR** is combustible Any **one** from the list above	**[1]**
(e) (i)	The air expands (And) goes into the collection apparatus	**[1]** **[1]**
(ii)	(Wait until) no more bubbles (of air are produced) in the water / syringe no longer moves	**[1]**
(f)	The mass of tube + hexane and mass of empty tube	**[1]**
	Temperature and pressure	**[1]**
	Syringe reading before hexane is added + the syringe reading after hexane is added	**[1]**
Qn1		**[Total: 15]**

<table>
<tr><th>Question</th><th>Expected Answer</th><th>Mark</th></tr>
<tr><td>2 (a)</td><td>
<table>
<tr><th>Temperature rise / °C</th><th>barium hydroxide added / mol</th></tr>
<tr><td>1.2</td><td>0.00292</td></tr>
<tr><td>2.4</td><td>0.00585</td></tr>
<tr><td>3.7</td><td>0.00877</td></tr>
<tr><td>4.7</td><td>0.0117</td></tr>
<tr><td>7.3</td><td>0.0175</td></tr>
<tr><td>9.7</td><td>0.0234</td></tr>
<tr><td>10.4</td><td>0.0292</td></tr>
<tr><td>10.4</td><td>0.0351</td></tr>
<tr><td>10.4</td><td>0.0468</td></tr>
</table>
Values in temperature column correct and to 1 decimal place
Values in barium hydroxide column are correct and to 3 sig figs</td><td>[1]
[1]</td></tr>
<tr><td>(b) (i)</td><td>All points plotted correctly</td><td>[1]</td></tr>
<tr><td>(ii)</td><td>Two best-fit straight lines drawn and then levelling to a horizontal line

The value on the x-axis is read correctly</td><td>[1]

[1]</td></tr>
<tr><td>(c)</td><td>The concentration of the acid is calculated as:
(2 × mol of $Ba(OH)_2$) × 1000 / 60</td><td>[2]</td></tr>
<tr><td>(d)</td><td>Exothermic reaction

After hydrochloric acid is neutralised / fully reacted OR barium hydroxide is in excess the temperature (rise) is constant</td><td>[1]

[1]</td></tr>
<tr><td>(e) (i)</td><td>Loss of heat (to the surroundings)

Greater temperature gradient OR the reaction is slower OR (rate of) heat loss is greater</td><td>[1]

[1]</td></tr>
<tr><td>(ii)</td><td>Give polystyrene cup a lid or cover / use a finer powder</td><td>[1]</td></tr>
</table>

Question	Expected Answer	Mark
(f)	Line rises less steeply and intersects second line at a lower temperature rise Maximum is reached at the same mol of barium hydroxide as the experiment with hydrochloric acid Some of the heat that would have been released is used to ionise the ethanoic acid	**[1]** **[1]** **[1]**
Qn2		**[Total: 15]**