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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

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Question	Expected Answer	Mark
1 (a)	$PV = nRT$ M_r = mass / amount in mol **OR** M_r = m / n **OR** g / n **OR** any of these formulae correctly re-arranged	**[1]** **[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 Shows appropriate connections to collect the air over water / in syringe (any size) using the side tube	**[1]** **[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 Temperature and pressure Syringe reading before hexane is added + the syringe reading after hexane is added	**[1]** **[1]** **[1]**
Qn1		**[Total: 15]**

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<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>

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

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