

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

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| Question | Expected Answer | Mark |
|----------|--|-------------|
| 1 (a) | $PV = nRT$ | [1] |
| | $M_r = \text{mass/amount in mol}$ 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: <ul style="list-style-type: none"> • 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] |

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|----------|---|------------------------------|------------------------------|-----|---------|-----|---------|-----|---------|-----|--------|-----|--------|-----|--------|------|--------|------|--------|------|--------|--|
| 2 (a) | <table border="1"> <thead> <tr> <th>Temperature rise / °C</th> <th>barium hydroxide added / mol</th> </tr> </thead> <tbody> <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> </tbody> </table> | Temperature rise / °C | barium hydroxide added / mol | 1.2 | 0.00292 | 2.4 | 0.00585 | 3.7 | 0.00877 | 4.7 | 0.0117 | 7.3 | 0.0175 | 9.7 | 0.0234 | 10.4 | 0.0292 | 10.4 | 0.0351 | 10.4 | 0.0468 | |
| | Temperature rise / °C | barium hydroxide added / mol | | | | | | | | | | | | | | | | | | | | |
| | 1.2 | 0.00292 | | | | | | | | | | | | | | | | | | | | |
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| | 10.4 | 0.0468 | | | | | | | | | | | | | | | | | | | | |
| | Values in temperature column correct and to 1 decimal place Values in barium hydroxide column are correct and to 3 sig figs | [1] [1] | | | | | | | | | | | | | | | | | | | | |
| (b) (i) | All points plotted correctly | [1] | | | | | | | | | | | | | | | | | | | | |
| (ii) | Two best-fit straight lines drawn and then levelling to a horizontal line | [1] | | | | | | | | | | | | | | | | | | | | |
| | The value on the x-axis is read correctly | [1] | | | | | | | | | | | | | | | | | | | | |
| (c) | The concentration of the acid is calculated as: $(2 \times \text{mol of Ba(OH)}_2) \times 1000 / 60$ | [2] | | | | | | | | | | | | | | | | | | | | |
| (d) | Exothermic reaction | [1] | | | | | | | | | | | | | | | | | | | | |
| | After hydrochloric acid is neutralised / fully reacted OR barium hydroxide is in excess the temperature (rise) is constant | [1] | | | | | | | | | | | | | | | | | | | | |
| (e) (i) | Loss of heat (to the surroundings) | [1] | | | | | | | | | | | | | | | | | | | | |
| | Greater temperature gradient OR the reaction is slower OR (rate of) heat loss is greater | [1] | | | | | | | | | | | | | | | | | | | | |
| (ii) | Give polystyrene cup a lid or cover / use a finer powder | [1] | | | | | | | | | | | | | | | | | | | | |

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|------------|---|--------------------|
| (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] |