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# MARK SCHEME for the October/November 2015 series

## 9701 CHEMISTRY

**9701/53** Paper 5 (Planning, Analysis and Evaluation), maximum raw mark 30

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| Question | Expected Answer | Mark |
|---|---|---|
| 1 (a) (i) | chlorobutane, bromobutane, iodobutane | [1] |
| | decreasing electronegativity of chlorine, bromine and iodine | [1] |
| (ii) | iodobutane, bromobutane, chlorobutane | [1] |
| | decreasing size of atoms of iodine, bromine and chlorine/decreasing bond length of the C-Hal bond | [1] |
| (b) (i) | The halogenoalkane(s)<br>AND<br>the amount of precipitate | [1] |
| (ii) | Equal moles / amounts are not being used | [1] |
| | Use same number of moles / amounts of halogenoalkane | [1] |
| (iii) | • Use the same amount of sodium hydroxide each time | [1] |
| | • heat water / oil bath / heating mantle (to 50 °C) | [1] |
| | • mix reagents / mix halogenoalkane and hydroxide **and** immediately start timer | [1] |
| | • add nitric acid | [1] |
| | • allow precipitate to settle | [1] |
| (iv) | The precipitates should be filtered and dried | [1] |
| | The precipitates should be weighed | [1] |
| (c) | Avoid the use of flames / keep away from flames / use a fume cupboard/wear a face mask / well ventilated room | [1] |
| | | **[15]** |

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| Question | Expected Answer | Mark |
|---|---|---|
| **2 (a)** | $K = \frac{[NO_2]^2}{[N_2O_4]}$ | [1] |
| **(b)** | $[NO_2(g)]^2 / mol^2\,dm^{-6}$<br>0.00531<br>0.00472<br>0.00413<br>0.00354<br>0.00300<br>0.00236<br>0.00152<br>0.00118<br>0.000590 | [1] |
| | All sig figs correct<br>All results for $[NO_2(g)]^2$ are correct | [1] |
| **(c) (i)** | All points plotted correctly | [1] |
| | Appropriate straight line drawn through the origin | [1] |
| **(ii)** | Points read correctly from the graph | [1] |
| | Gradient calculated correctly | [1] |
| | $K_c$ given to 3 sig figs with correct units: $mol\,dm^{-3}$ | [1] |
| **(d)** | Point at $[N_2O_4] = 0.3\,mol\,dm^{-3}$ chosen or other valid anomalous point | [1] |
| | Equilibrium has not been properly established / the temperature was lower than (25 °C)/ temperature was too low | [1] |

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|---|---|---|
| **(e) (i)** | Straight line through the origin(± ½) with steeper gradient. | [1] |
| **(ii)** | Reaction is endothermic. | [1] |
| **(i)** | Value of $K_c$ will be higher | [1] |
| **(iv)** | No change | [1] |
| **(f)** | 0.9 + (0.0729/2) = 0.9 + 0.03645<br>0.93645 mol $dm^{-3}$ | [1] |
| | | **[15]** |

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