

Question	Marking guidance	Mark	AO	Comments
09.1	Start a clock when KCl is added to water Record the temperature every subsequent minute for about 5 minutes Plot a graph of temperature vs time Extrapolate back to time of mixing = 0 and determine the temperature	1 1 1 1	AO3 2b AO3 2b AO3 2a AO3 2a	Allow record the temperature at regular time intervals until some time after all the solid has dissolved for M2
09.2	Heat taken in = $m \times c \times \Delta T = 50 \times 4.18 \times 5.4 = 1128.6 \text{ J}$ Moles of KCl = $5.00/74.6 = 0.0670$ Enthalpy change per mole = $+1128.6/0.0670 = 16\,839 \text{ J mol}^{-1}$ $= +16.8 \text{ (kJ mol}^{-1}\text{)}$	1 1 1 1	AO2h AO2h AO2h AO1b	Max 2 if $14.6 \text{ }^\circ\text{C}$ used as ΔT Answer must be given to this precision
09.3	$\Delta H_{\text{solution}} = \Delta H_{\text{lattice}} + \Delta H(\text{hydration of calcium ions}) + 2 \times \Delta H(\text{hydration of chloride ions})$ $\Delta H_{\text{lattice}} = \Delta H_{\text{solution}} - \Delta H(\text{hydration of calcium ions}) - 2 \times \Delta H(\text{hydration of chloride ions})$ $\Delta H_{\text{lattice}} = -82.9 - (-1650 + 2 \times -364) = +2295 \text{ (kJ mol}^{-1}\text{)}$	1 1	AO2f AO2f	
09.4	Magnesium ion is smaller than the calcium ion Therefore, it attracts the chloride ion more strongly / stronger ionic bonding	1 1	AO2a AO2a	