Experiment 2-Prelab Exercise

1) a) The ionic compound would be completely dissolved in H_2O, and would form a change in heat energy.

$$X^+Y^-(s) + H_2O(l) \rightarrow X^+(aq) + Y^-(aq)$$

b) Gaseous ions → lattice energy of the ionic compound would form the enthalpy change $X^+(g) + Y(g) \rightarrow X^+Y^-(s)$

c) The enthalpy change when gaseous ions of the compound are dissolved in H_2O forms aqueous ions

$$Z^+(g) \rightarrow Z^+(aq)$$

2) Each enthalpy change is related because each one is formed from different conditions and states of matter, but they all relate to a change in energy. Enthalpy of solution can be calculated using enthalpy hydration and lattice energy

3) a) $NH_4^+(g) + Cl^-(g) \rightarrow NH_4Cl(s)$

ΔH (hydration) $(NH_4^+) = -307\ kJ/mol^-$

ΔH (hydration) $(Cl^-) = -381\ kJ/mol$

ΔH (lattice) $(NH_4Cl) = -705\ kJ/mol$

ΔH (solution) $(H_4Cl) = -(-705) + (-307) + (-381) = +17\ kJ/mol$

b) $NH_4^+(g) + NO_3^-(g) \rightarrow NH_4NO_3(s)$

ΔH(hydration) $(NH_4^+) = -307\ kJ/mol$

ΔH (hydration) $(NH_4^+) = -307\ kJ/mol$

ΔH(lattice) $(NH_4NO_3) = -646\ kJ/mol$

ΔH (solution) $(NH_4NO_3) = -(-646) + (-307) + (-314) = +25\ kJ/mol$

4) $Q = m\,C\,\Delta T$

$m = 210\,g$

$C = 4.18\ JK^{-1}g^{-1}$

$T = 40°C$

$Q = (210g)(4.18\ JK^{-1}g^{-1})(40°C) = 35112\ J$ or $35.1\ kJ$

minimum mass of $CaO = 35.1\ kJ \div 82\ kJ\,mol^{-1} = 0.43\ mol$

$0.43\ mol \times 56.1\ g\,mol^{-1} = 24.0\ g$ of CaO