

AP LAB 05f: Endothermic Reactions & Entropy

Aim To investigate the relationship between entropy and enthalpy

Apparatus Coffee-cup calorimeter, thermometer, weighing boat, spatula, goggles, electronic balance

Chemicals 1.0 M Citric acid solution, sodium hydrogen carbonate solid

Method

1. Measure 25.0 mL of the citric acid solution into a coffee-cup calorimeter, and record the temperature of the solution. (Allow a few minutes for the temperature to become constant before recording.)
2. Record the exact mass of approx. 6.40-6.60 g of sodium hydrogen carbonate.
3. With the thermometer already in the calorimeter, **carefully** add the sodium hydrogen carbonate to the acid.

(NOTE: The solid must be added VERY SLOWLY, a little at a time, to avoid the contents of the cup effervescing and the contents being lost)

4. Gently stir the contents of the calorimeter monitoring the temperature constantly. **Record the lowest temperature reached.**
5. Repeat the experiment to obtain data in a second trial.

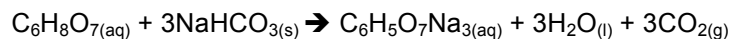
Results

	Trial 1	Trial 2
Initial temperature of solution in °C		
Final temperature of solution in °C		
Mass of sodium hydrogen carbonate added in g		



Calculations/Conclusions

Make the assumption that the specific heat capacity of the solution is $4.18 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$, and that the density of the solution is 1.00 g mL^{-1} . You may ignore the heat capacity of the calorimeter.



1. Determine the limiting reactant in the reaction.
2. Calculate the change in energy of the surroundings, $q_{\text{surroundings}}$, in units of Joules for each trial, and then average the two values.
3. Use your answer in Q2 to calculate a value for the q_{system} in kJ molrxn^{-1} , i.e., calculate ΔH° for the reaction. **(Use the average number of moles of the limiting reactant in your calculation).**
4. *Based only upon your calculation of ΔH°* , predict the sign of ΔS° for the reaction. Justify your choice.
5. *Based only on the balanced equation*, predict the sign of ΔS° for the reaction. Justify your choice.