Enthalpy of Diluting Strong Acids Worksheet

The addition of a strong acid to water generates heat; that is, the reaction is exothermic. In this worksheet you will determine the change in temperature when H_2SO_4 is added to water and consider one of its implications.

When adding concentrated sulfuric acid to water the following reaction takes place

$$H_2SO_4(l) \rightarrow H^+(aq) + HSO_4^-(aq)$$

Calculate ΔH for this reaction given that the heats of formation for $H_2SO_4(l)$, $H^+(aq)$, and $HSO_4^-(aq)$ are -813.989 kJ/mol$_{rxn}$, 0 kJ/mol$_{rxn}$ (defined), and -885.75 kJ/mol$_{rxn}$, respectively.

Now, suppose you carry out this reaction in a calorimeter by mixing 10.0 mL of concentrated (18.0 M) H_2SO_4 with enough water to give a final volume of 100.0 mL. The density of the resulting solution is 1.08 g/mL and its specific heat is 3.50 J/g·^{o}C. If the initial temperature is 25.0^{o}C, what is the final temperature (assuming a perfect calorimeter that neither absorbs heat nor loses heat to the surroundings)?

Based on the result of your calculations, speculate on why instructions for preparing dilute solutions of strong acids always emphasize that the strong acid should be added to water instead of adding water to the strong acid.