Chemistry 140 Name(s):

Exercise 8: Enthalpy changes

1. a. A covered Styrofoam cup contains 26.05 g of distilled water at 27.20°C. A 0.2000 carat diamond at 74.21°C is added to the water. What is the final temperature of the system? Constants and conversions: 1 carat = 10.25 g; C_p (water) = 4.184 J/g °C; C_p (diamond) = 0.5091 J/g °C. By the way, this is a good way to test for diamonds, since other materials that look like diamonds have much different C_ps.

b. What assumption(s) did you make about the nature of the materials and the heat transfer in the system?

c. How would performing the experiment in an aluminum cup weighing 50.0 g affect the result of your calculation? In fact, look up an appropriate number for aluminum in the textbook, re-setup the equation and determine the final temperature. You may also want to revise your assumptions in part b.

2. a. For your party this weekend, you pull a block of party ice weighing 10 pounds out of a -20°C commercial freezer. During the party, it sits in a tub in the living room and melts, eventually reaching 37°C, the temperature of the air warmed by all the people in the room. What is the **ΔH** of this process? The specific heat of water = 4.184 J/gK, the specific heat of ice = 2.11 J/gK, $\Delta H_{\text{fusion of ice}}$ = 6.01 kJ/mol and 1 pound = 453.6 grams.

b. Some wag suggests that a great way to burn off all those chips you ate at the party is to consume the 10 pounds of party ice you bought. "After all, your body will burn enough calories (from the chips, presumably) to bring the water up to normal body temperature!" she says. Is she right (assume that a bag of chips has 60 **food** calories)? Is this a good weight loss method?

3. Calculate $\mathbf{\Delta H_{rxn}^{\circ}}$ (in kJ/mol) for the neutralization reaction using the standard heats of formation:

$HCl\ (aq) + NaOH\ (aq) \rightarrow NaCl\ (aq) + H_2O\ (l)$

Use the data in the appendix; standard state for solutions is 1.00 M concentration at 25°C and 1 bar of pressure. Hint: Notice that you will have to write the **net ionic equation** of this reaction before you can use the information in the appendix!