Chem E-1a
Friday Review Problems
Chapter 6: Energy Relationships in Chemical Reactions

1. a) Write a complete balanced equation for the combustion of **one mole** of solid sucrose, $C_{12}H_{22}O_{11}$. Include state symbols such as (*s*) and (*g*).

   b) A bomb calorimeter and its contents has a total heat capacity of 10.73 kJ/°C. When 1.243 g of sucrose are completely combusted in this calorimeter, the temperature increases by 1.91°C. Use this information to calculate the standard enthalpy change $\Delta H°$ for the combustion of sucrose in kJ/mol.

   c) Now use the information provided below to calculate the standard enthalpy change $\Delta H°$ for the combustion of solid sucrose.

   $\Delta H°_f\,(CO_2\,(g)) = -393.5$ kJ/mol

   $\Delta H°_f\,(H_2O\,(l)) = -285.8$ kJ/mol

   $\Delta H°_f\,(C_{12}H_{22}O_{11}\,(s)) = -2221.7$ kJ/mol

2. You wish to prepare a pitcher of iced tea by mixing some amount of ice at –10°C with 400 g of hot tea at 80°C. You want your final pitcher of iced tea to be at 10°C. Determine the mass of ice you should use. **Useful Info**: specific heat of ice = 2.09 J/g°C
   specific heat of tea = specific heat of liquid water = 4.18 J/g°C
   $\Delta H°_{fusion}$ (H_2O) = +6.01 kJ/mol

2. (cont. – Additional space for work.)

3. a) Given the following information:

$NO\ (g) + NO_2\ (g) \rightarrow N_2O_3\ (g)$ $\quad \Delta H° = -40$ kJ/mol

$N_2O_4\ (g) \rightarrow 2\ NO_2\ (g)$ $\quad \Delta H° = 58$ kJ/mol

Calculate $\Delta H°$ for the following reaction:

$2\ N_2O_3\ (g) \rightarrow 2\ NO\ (g) + N_2O_4\ (g)$

b) Calculate ΔU, q and w for the complete reaction of 5 moles of N_2O_3 (*g*) according to the above reaction at 25°C with a constant external pressure of 1.00 atm.

3. (cont. – Additional space for work.)