Problem Set #3

Due Monday, 9/29/99, in class.

Show your work. Problem sets will be spot graded. Work must be shown.

R = 0.08206 liter atm K^{-1} mole^{-1} = 8.314 J K^{-1} mole^{-1}

1. Some organisms such as yeast convert glucose to ethanol.
   
   (a) Write a balanced equation for the process
   
   \[ \text{glucose (s)} \rightarrow \text{ethanol (l)} + \text{carbon dioxide (g)} \]
   
   and calculate $\Delta H$, $q$, $w$, and $\Delta E$ for the reaction of 1 mole of glucose at 298K, 1 atm. Neglect the volumes of solids and liquids.
   
   (b) Suppose the same reaction is carried out by a thermophilic organism which lives at 80˚C, 1 atm. Calculate $\Delta H$ under these conditions. Ignore the heats of solution of the products and reactants. $C_p(\text{ethanol(l)}) = 111.5 \text{ J/moleK}$, $C_p(\text{glucose(s)}) \approx 210 \text{ J/moleK}$, $C_p(\text{carbon dioxide(g)}) = 37.1 \text{ J/moleK}$.
   
   (c) Suppose the same reaction is carried out at 1 atm in an insulated container so that no heat is lost to the surroundings. If the reaction occurs in 1 kg of water (again ignore heats of solution), what is the final state of the water -- temperature and phase? This time assume the total reaction solution has the same heat capacity as liquid water (4.18 kJ/kgK) and that the reaction itself occurs quickly -- it is complete at 298K, before any temperature changes can occur.
   
   (d) Which process a, b, or c does more work? Briefly explain why.

2. T,S,&W Ch 3 Pb 6

3. T,S,&W Ch 3 Pb 15

4. T,S,&W Ch 3 Pb 17

5. T,S,&W Ch 3 Pb 24

6. T,S,&W Ch 3 Pb 26

7. T,S,&W Ch 3 Pb 27