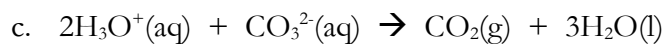
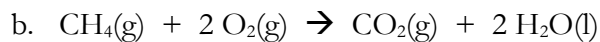
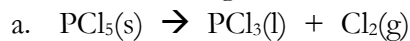


**Due Thursday 11/19/2020**

1. Predict the sign of  $\Delta S$  in the system for each of the following reactions



2. Use the data from the appendix in the back of your book to calculate  $\Delta S^\circ_{\text{sys}}$ ,  $\Delta S^\circ_{\text{surr}}$  and  $\Delta S^\circ_{\text{total}}$  at 25°C for the reactions. Is the reaction spontaneous under standard-state conditions at 25°C?

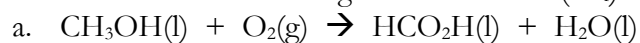


3. Use the standard entropy to calculate  $\Delta S^\circ_{\text{surr}}$  and  $\Delta S^\circ_{\text{univ}}$  and Gibbs free energy  $\Delta G^\circ$  for the following reaction at 25°C.

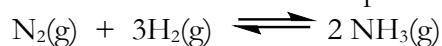


Determine the at what temperature will the reaction become spontaneous or nonspontaneous or NEVER

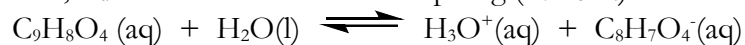
4. Use the standard free energies of formation ( $G^\circ_f$ ) to calculate the  $\Delta G^\circ$  (in kJ) for the following reactions



5. Calculate  $\Delta G$  for the Haber process at 365 K for a mixture of 1.5 atm  $\text{N}_2$ , 4.5 atm  $\text{H}_2$  and 0.75 atm  $\text{NH}_3$



6. At 25°C,  $K_a$  for acid dissociation of aspirin ( $\text{C}_9\text{H}_8\text{O}_4$ ) is  $3.0 \times 10^{-4}$ . Calculate  $\Delta G^\circ$  for the reaction



7. Consider the dissolution of AgBr in water at 25°C



a. Use the standard heats formation and standard molar entropies to calculate  $\Delta G^\circ$  for the reaction

b. Calculate  $K_{sp}$  for AgBr at 25°C

c. Calculate  $\Delta G$  for the dissolution of AgBr at 25°C when  $[Ag^+] = [Br^-] = 1.00 \times 10^{-5} \text{ M}$   
Is your result consistent with the relative values of  $Q$  and  $K_{sp}$

8. If  $\Delta G^\circ_f$  for gaseous bromine is 3.14 kJ/mol at 25°C above bromine solid, what is the vapor pressure of bromine? (Hint: write the chemical equation for the sublimation of bromine solid)