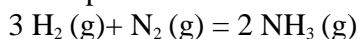


Handin Homework 11: Solutions and Chemical Equilibria

1. At 30.0°C the vapor pressure of pure toluene and pure benzene are 36.7 and 118.2 torr, respectively. The two liquids form nearly an ideal solution. (a) For a solution containing 50.0 mole % of toluene, calculate the total vapor pressure and the mole % of each component in the vapor phase. (b) What is the composition of a solution of benzene and toluene that will boil at 30.0°C at a pressure of 50.0 torr?

2. The Haber process for the formation of ammonia is



When a system containing hydrogen, nitrogen, and ammonia reached equilibrium at 400.°C, the partial pressures of the three gases was found to be: $P(\text{H}_2)=12.7$ atm, $P(\text{N}_2)=17.9$ atm, and $P(\text{NH}_3)= 2.45$ atm. (a) Calculate K_p using a 1 atm standard state. (b) Calculate K_p using a 1 bar standard state. In these calculations make sure to use the true thermodynamic equilibrium constant, that is remember to divide by P° . (c) Calculate $\Delta_r G^\circ_{400^\circ\text{C}}$ for both standard states.

3. At 1105. K, the value of K_p for the reaction $\text{SO}_2 (\text{g}) + 1/2 \text{O}_2 (\text{g}) = \text{SO}_3 (\text{g})$ is 0.630 (with a 1 bar standard state).

(a) Calculate the standard Gibb's Free Energy change at 1105. K for this reaction.

(b) Calculate the Gibb's Free Energy change at 1105. K for the reaction:

