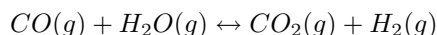


CHEM 3410: Physical Chemistry I — Fall 2008

Homework 6

Due in Class: October 21, 2009

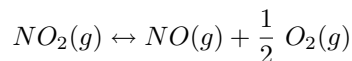
1. Consider the equilibrium:



At 1000 K the equilibrium composition of the reaction mixture is:

Substance	CO ₂ (g)	H ₂ (g)	CO(g)	H ₂ O(g)
Mole %	27.1	27.1	22.9	22.9

- (a) Calculate K_p and ΔG_{rxn}° at 1000 K.
- (b) Given the answer to part (a), use the tabulated data for ΔH_f° of the reaction species to calculate ΔG_{rxn}° at 298 K. Assume ΔH_{rxn}° is independent of temperature in this range.
2. Consider the gas phase reaction of NO₂ shown below. At $T = 700$ K, the equilibrium constant $K_p = 0.379$. At a total pressure of 2 atm, the partial pressure of oxygen in the reaction is 0.378 atm at equilibrium. Determine the molar standard state free energy of reaction ($\Delta \bar{G}_{rxn}^\circ$) and the equilibrium composition of the gas mixture (final partial pressure of each component) for these conditions.



3. Ca(HCO₃)₂(s) decomposes at elevated temperatures according to the stoichiometric equation:



- (a) If pure Ca(HCO₃)₂(s) is put into a sealed vessel, the air is pumped out, and the vessel and its contents are heated, the total pressure is 0.115 bar. Determine K_p under these conditions.
- (b) If the vessel initially also contains 0.225 atm H₂O(g), what is the partial pressure of CO₂(g) at equilibrium?