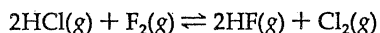
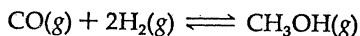


Supplemental Problems (Brady book)

- 15.18 Use the data in Table 14.4 (p. 478) to calculate K_p at 25 °C for the reaction

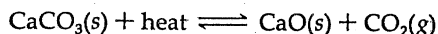


- 15.26 Methyl alcohol, CH_3OH , is a fuel that can be made from carbon monoxide (produced by burning coal) and hydrogen. The equilibrium is



At 427 °C (700 K) a mixture of CO , H_2 , and CH_3OH having the following partial pressures was prepared: $p_{\text{CO}} = 2 \times 10^{-3} \text{ atm}$, $p_{\text{H}_2} = 1 \times 10^{-2} \text{ atm}$, $p_{\text{CH}_3\text{OH}} = 3 \times 10^{-6} \text{ atm}$. For this reaction, $\Delta G_{700\text{K}}^\circ = -13.5 \text{ kJ}$. Use Equation 15.2 to determine whether this system is at equilibrium. If not, will the reaction proceed spontaneously to the left or the right?

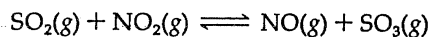
- 15.41 In the equilibrium



how will the amount of $\text{CaCO}_3(\text{s})$ change if

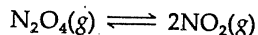
- (a) CaO(s) is added?
- (b) $\text{CO}_2(\text{g})$ is added?
- (c) the volume of the container is increased?
- (d) the temperature is lowered?

- 15.44 At 460 °C, $K_c = 85.0$ for the reaction



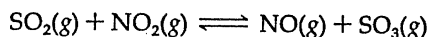
A mixture of these gases has the following concentrations of the reactants and products: $[\text{SO}_2] = 0.040 \text{ M}$, $[\text{NO}_2] = 0.50 \text{ M}$, $[\text{NO}] = 0.30 \text{ M}$, $[\text{SO}_3] = 0.020 \text{ M}$. Is this system at equilibrium? If not, in which direction must the reaction proceed to reach equilibrium?

- 15.46 At 25 °C, in a mixture of N_2O_4 and NO_2 in equilibrium at a total pressure of 0.844 atm, the partial pressure of N_2O_4 is 0.563 atm. Calculate for the reaction



(a) K_p , (b) K_c , (c) $\Delta G_{298\text{K}}^\circ$ in kJ.

- 15.52 Suppose a mixture of SO_2 , NO_2 , NO , and SO_3 having the initial concentrations $[\text{SO}_2] = 0.0100 \text{ M}$, $[\text{NO}_2] = 0.0200 \text{ M}$, $[\text{NO}] = 0.0100 \text{ M}$, and $[\text{SO}_3] = 0.0150 \text{ M}$ is prepared at 460 °C. At this temperature the reaction



has $K_c = 85.0$. What will be the molar concentrations of the four gases at equilibrium?

- 15.56 In a 10.0-L mixture of H_2 , I_2 , and HI at equilibrium at 425 °C, there are 0.100 mol of H_2 , 0.100 mol of I_2 , and 0.740 mol of HI . If 0.50 mol of HI is now added to this system, what will be the molar concentrations of H_2 , I_2 , and HI once equilibrium has been reestablished?