Chemistry 236 -- Practice Quiz 6

October 15, 2003 — Spectrophotometric Determination of *K*

1. Our treatment of the stoichiometry for the $I_2 + M \leftrightarrow I_2{\bullet}M$ reaction yielded a straight-line relationship permitting us to extract K and ε_x from an appropriate plot of "y" *vs*. "x." If this expression is written as $y = a + bx$, the equilibrium constant K is given by

   a. a / b b. b / a c. $a \times b$ d. $1/a$ e. none of these

2. For the following reaction, $K = 8.6 \times 10^{19}$ at 25°C and $K = 1.09 \times 10^{15}$ at 125°C:

   $$Cl_2(g) + F_2(g) \rightleftarrows 2\ ClF(g)$$

   Assuming that $\Delta H°$ and $\Delta S°$ are independent of T over this range, calculate $\Delta S°$.

   a. 3.7 J K^{-1} mol^{-1} b. 8.5 J K^{-1} mol^{-1} c. 11.3 J K^{-1} mol^{-1}
   d. –111.2 J K^{-1} mol^{-1} e. –113.7 J K^{-1} mol^{-1}

3. The reaction $A + B \leftrightarrow C$ is studied experimentally by mixing together solutions of A and B and determining concentrations at equilibrium. 10.0 mL of 0.036 M A is mixed with 5.0 mL of 0.126 M B, and at equilibrium [C] is found to be 0.0094 M. What is the value of K for this reaction?

   a. 2.1 L mol^{-1} b. 3.0 L mol^{-1} c. 9.3 L mol^{-1} d. 19.7 L mol^{-1} e. none of these

4. In the preceding reaction, A and B are both monitored spectrophotometrically. B alone absorbs at 600 nm, with $\varepsilon_{B,600} = 550$ L mol^{-1} cm^{-1}, while both A and B absorb at 400 nm, with $\varepsilon_{A,400} = 800$ L mol^{-1} cm^{-1} and $\varepsilon_{B,400} = 270$ L mol^{-1} cm^{-1}. C has negligible absorption at both wavelengths. A reaction mix yields $A_{600} = 0.89$ and $A_{400} = 1.03$ for a 1.00-cm path length. If the initial concentration of A was $[A]_0 = 1.00 \times 10^{-3}$ M, what is K for the reaction?