SCH4U1 Name:
ET06 Date:

EQUILIBRIUM CONSTANT - WORKSHEET 2

1. Write the equilibrium constant expression for each of the following reactions:
   a) $N_2\,(g) + O_2\,(g) \rightleftharpoons 2\,NO_2\,(g)$
   b) $2\,C(s) + 3\,H_2\,(g) \rightleftharpoons C_2H_6\,(g)$
   c) $I_2\,(aq) \rightleftharpoons I_2\,(s)$

2. For the following reaction:
   $Fe^{2+}\,(aq) + Ag^{+}\,(aq) \rightleftharpoons Fe^{3+}\,(aq) + Ag\,(s)$
   At equilibrium, $[Fe^{2+}] = 0.50$ M, $[Ag^{+}] = 1.0$ M, $[Fe^{3+}] = 1.50$ M
   a) Calculate the equilibrium constant for the reaction.
   b) If at equilibrium, $[Fe^{2+}] = 0.20$ M and $[Ag^{+}] = 0.30$ M, what must be the concentration of Fe^{3+}?

3. $2\,NO\,(g) + O_2\,(g) \rightleftharpoons 2\,NO_2\,(g)$ $\quad K = 5.0 \times 10^{-5}$
   Calculate the equilibrium concentration of oxygen gas if the NO and NO_2 concentrations are equal at equilibrium.

4. a) $CH_3COOH\,(aq) \rightleftharpoons H^{+}\,(aq) + CH_3COO^{-}\,(aq)$ $\quad K = 1.8 \times 10^{-5}$
   b) $H^{+}\,(aq) + HS^{-} \rightleftharpoons H_2S\,(aq)$ $\quad K = 1.0 \times 10^{7}$
   Which of the above reactions would have the greatest amount of products present at equilibrium compared to reactants?

5. For the reaction:
   $$N_{2\,(g)} + 3\,H_{2\,(g)} \rightleftharpoons 2NH_{3\,(g)} + 92kJ$$
   at an equilibrium temperature of 1000°C, a 1.00 L flask contains 0.120 moles of ammonia, 1.03 moles of nitrogen and 1.62 moles of hydrogen. Calculate the equilibrium constant at this temperature.

6. For the following equilibrium reaction:
   $$N_2O_{4\,(g)} + 58.9\ kJ \rightleftharpoons 2NO_{2\,(g)}$$
   a one litre flask at 55°C is found to contain 3.6 moles of $N_2O_{4\,(g)}$ in equilbrium with 1.75 moles of $NO_{2\,(g)}$. Calculate the value of K_{eq} for this reaction.

7. For the following reaction at equilibrium at 2000°C, $K_{eq} = 1.6 \times 10^{3}$.
   $$2\,NO_{(g)} \rightleftharpoons N_{2\,(g)} + O_{2\,(g)}$$
   The concentration of NO is 0.13 mol/L. If the concentrations of N_2 and O_2 are equal, calculate the concentration of N_2.

8. At equilibrium at 1120°C the concentration of the reactants and products are measured and found to be CO = 0.010M, H_2O = 0.020M, CO_2 = 0.010M, and H_2 = 0.010M. For the following reaction, does the equilibrium favour the formation of the products or the reactants?
   $$CO_{(g)} + H_2O_{(g)} \rightleftharpoons H_{2\,(g)} + CO_{2\,(g)}$$

9. At 800°C the equilibrium constant for the following reaction is 0.279.

$$CO_{2\,(g)} + H_{2\,(g)} \rightleftharpoons H_2O_{(g)} + CO_{(g)} \qquad \Delta H = 42.6 \text{ kJ/mol}$$

At a different temperature the equilibrium constant is 0.100. Is this different temperature higher or lower than 800°C? Give your reasoning.