Equilibrium Review

1. Write the equilibrium expression for the reaction shown below.
   $4NH_{3(g)} + 5O_{2(g)} \leftrightarrow 4NO_{(g)} + 6H_2O_{(l)}$

2. Initially in a 3 L container, there are 1.2 mol of NO_2 and 0.96 mol N_2O_4. Find all equilibrium concentrations.
   $2NO_2 \leftrightarrow N_2O_4 \quad K_c = 0.5$

3. For the following reaction, NO is brown and all else are clear. Tell the shift (right or left) and the color change.
   $4NH_{3(g)} + 5O_{2(g)} \leftrightarrow 4NO_{(g)} + 6H_2O_{(l)} \quad \Delta H = +55$ kJ
   a) NH_3 is removed
   b) H_2O is added
   c) Temperature is decreased
   d) Pressure is decreased
   e) Volume is decreased
   f) Catalyst is added
   g) He is added

4. If at equilibrium in a 4 L container there are 1.6 mol of A, 0.8 mol of B, and 1.2 mol of each C and D, a) Find K. b) If now there is a new equilibrium with [A] = 0.6 M, [C] = 0.3 M, and [D]= 0.1 M, find [B]
   $4A + 2B \leftrightarrow C + 3D$

5. Find the % HCl turned to product if initially there is 0.6 M HCl. K = 2.
   $2HCl_{(g)} \leftrightarrow H_{2(g)} + Cl_{2(g)}$

6. Initially in a 3 L container, there are 1.2 mol of NO_2. At equilibrium, there are 0.9 **moles** of NO_2. A) Find Kc. B) Find Kp at 25°C.
   $2NO_2 \leftrightarrow N_2O_4$

7. Initially, [A] = [B] = 1.2 M, and [C] = 0.4 M.
   $2A + 3B \leftrightarrow 4C \qquad K_c = 2 \times 10^2$
   a) Find Q
   b) Which way does the reaction shift to attain equilibrium?

8. A sample of ammonium carbonate is heated and decomposes as shown below. At a certain temperature, K_P is 0.048. Find the total pressure.

   $(NH_4)_2CO_{3(s)} \leftrightarrow 2NH_{3(g)} + H_2O_{(g)} + CO_{2(g)}$

9. Given: $H_2 + CO_2 \leftrightarrow H_2O + CO \quad K = 2$
   Find
   a) K for $3H_2 + 3CO_2 \leftrightarrow 3H_2O + 3CO$
   b) K for $H_2O + CO \leftrightarrow H_2 + CO_2$