Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ #\_\_\_\_\_\_

Honors Chemistry Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period\_\_\_\_\_\_\_\_

# Equilibrium Expressions Worksheet

Equilibrium constant (Keq)

The relationship between the concentration of products and reactants at equilibrium can be expressed by an equilibrium constant. (Keq) [ ] denotes molar concentrations

 When writing equilibrium expressions, reactants or products that are pure solids or pure liquids do not appear in the expression since no matter how much of it you have, it is considered to be pure. Pure before the reaction, pure after the reactionthe [ ] does not change.

a.

1. Write the following equilibrium expressions in each box:

 a. O3 (g) + NO(g) → O2(g) + NO2(g)

 b. 2CO(g) + O2(g) → 2CO2(g)

 c. NH4NO3(s) → N2O(g) + 2H2O(l)

 d. 2H2O(g) → 2H2(g) + O2(g)

b.

d.

c.

Calculations involving Keq

The concentrations of the gases involved in the reversible reactions **at equilibrium** are known as the equilibrium concentrations. Since Keq represents the system at equilibrium, only these concentrations can be used in the equilibrium expression. (NOT THE INITIAL CONCENTRATIONS!)

2. PCl5(g) → PCl3(g) + Cl2(g). What is the equilibrium constant if the equilibrium concentrations are as follows: PCl5 is 0.0096 mol/L, PCl3 is 0.0247 mol/L and Cl2 is 0.0247 mol/L? Ans: 0.064

3. At 1000oC, a 1.00 L container has an equilibrium mixture consisting of 0.102 mol of ammonia, 1.03 mol of nitrogen, and 1.62 mol of hydrogen. Calculate the Keq for the equilibrium system.

 Ans: 0.00238

4. At a given temperature, the Keq for the reaction 2HI(g) → H2(g) + I2(g) is 1.40 x 10-2. If the concentration of both H2 and I2 at equilibrium are 2.00 x 10-4M, find the concentration of HI.

 Ans: 0.00169M

5. Acetic acid dissociates in water. If Keq = 1.80 x 10-5 and the equilibrium concentrations of acetic acid is 0.09986M, what is the concentration of H+(aq) and C2H3O2-(aq)? Ans: 0.00134M

HC2H3O2(aq) →H+(aq) + C2H3O2-(aq)

6. At 60.2oC the equilibrium constant for the reaction N2O4(g) → 2NO2(g) is 8.75 x 10-2. At equilibrium at this temperature a vessel contains N2O4 at a concentration of 1.72 x 10-2M. What concentration of NO2 does it contain? Ans: 0.0388M

7. At equilibrium, K for the decomposition of HI(g) was found to be 1.07 x 10-5. The equilibrium concentration of HI(g) was found to be 0.129M. Calculate the concentration of I2 at equilibrium.

(Hint – Let x = the concentration of I2. What would the concentration of H2 be if x is the concentration of I2? Refer to the coefficients of the equation to help you.) 2HI(g) → H2(g) + I2(g)

 Ans: 0.000422M

In each problem, calculate the missing concentration or constant at equilibrium.

 [HI] [H2] [I2] Keq

8. 1.78 0.172 0.172 X Ans: 0.00934

9. X 0.242 0.242 0.217 Ans: 0.519

10. 0.78 0.112 X 2.06 x 10\_2 Ans: 0.112