**Worksheet #11                      Review, Ktrial (Q), & Size of Keq**

 1.         2 CrO4-2 (aq) + 2H+ (aq) ⇄   Cr2O7-2 (aq) + H2O (l) Calculate the Keq if the following amounts were found

at equilibrium in a 2.0L volume. CrO4-2 = .030 mol, H+ = .020 mol, Cr2O7-2= 0.32 mol, H2O = 110 mol

2.         PCl5(s) + H2O(g)   ⇄   2HCl (g) + POCl3 (g)     Keq= 11 . At equilibrium the 4.0L flask contains the indicated

amounts of the three chemicals.     PCl5= 0.012 mol,  H2O  = 0.016 mol,  HCl  = 0.120 mol. Calculate [POCl3].

3.   If 6.0 moles H2S are placed in a 2.0 L container. At equilibrium 5.0 moles H2 are present. Calculate the Keq.

           2H2S(g)  ⇄  2H2(g) + S2(g)

4.   4.0 moles HBr is placed in a 10 L container at 180oC. Calculate the concentration of H2(g) at equilibrium if the Keq for the reaction at 180oC is 15.6.

H2(g) + Br2(g) ⇄ 2HBr(g)

5.    At 2000 0C Keq = 11.6 for:     2NO(g) ⇄ N2(g) + O2(g).    If some NO was placed in a 2.0 L vessel, and the

equilibrium [N2] = 0.120 M, calculate all other equilibrium concentrations.

6.    At 800oC, Keq = 2.8 x 10-7 for CO2(g) + H2(g) ⇄ CO(g) + H2O(g).    If 2.00 moles CO2( g) and 2.00 moles H2(g)are placed  in a 500.0 mL container, calculate all equilibrium concentrations.

7.    CO(g) + H2O(g) ⇄ CO2(g) + H2(g)           Keq= 10.0 at 690oC.      If at a certain time [CO] = 0.80 M, [H2O] = 0.050 M,

[CO2] = 0.50 M and [H2] = 0.40 M, is the reaction at equilibrium?

If not, how will it shift in order to get to equilibrium

8.   For the reaction: CO(g) + H2O(g) ⇄ CO2(g) + H2(g)        Keq= 10.0 at 690 oC.  The following concentrations were observed: [CO]=2.0 M, [H2]= 1.0 M, [CO2]=2.0 M, [H2O] = 0.10 M. Is the reaction at equilibrium? If not, how will it shift in order to get to equilibrium?

9.   For the equation below, the following concentrations were noted: [CO] = 1.5 M, [H2] = 1.2 M, [CO2] = 1.0 M,

[H2O] = 0.10 M. Is the reaction at equilibrium? If not, how will it shift in order to get to equilibrium?

CO (g) + H2O (g) ⇄ CO2 (g) + H2 (g)       Keq= 10.0 at 690oC

10.  At a certain temperature the Keq for a reaction is 75.  2O3(g)⇄  3O2(g)

Predict the direction in which the equilibrium will proceed, if any, when the following amounts are introduced to a 10 L vessel.

a) 0.60 mole of O3 and 3.0 mol of O2

 b) 0.050 mole of O3 and 7.0 mol of O2

 c) 1.5 mole of O3 and no O2

11)       Consider the following equilibriums:

 a) 2NO2 (g)⇄   N2O4 (g)                                                           Keq = 2.2

b) Cu2+(aq)+   2Ag(s)  ⇄ Cu(s)+   2Ag+ (aq)                             Keq = 1 x 10-15

c) Pb2+ (aq)    +   2  Cl- (aq)   ⇄     PbCl2(s)                               Keq = 6.3 x  104

d) SO2(g)    +   O2 (g) ⇄     SO3 (g)                                             Keq = 110

 i)    Which equilibrium favours products to the greatest extent?                  \_\_\_\_\_\_

ii)   Which equilibrium favours reactants to the greatest extent?                  \_\_\_\_\_\_

12.       What is the only way to change the value of the Keq?

13.       In the reaction: A + B ⇄ C + D + 100 kJ, what happens to the value of Keq if we increase the temperature?

14.    If the value of Keq decreases when we decrease the temperature, is the reaction exothermic or endothermic?

15.    In the reaction; W + X + 100kJ ⇄ Y + Z, what happens to the value of Keq if we increase the (X)? Explain your answer.

16.       If the value of Keq increases when we decrease the temperature, is the reaction exothermic or endothermic?

17.       Predict whether reactants of products are favored in the following equilibrium systems

(a)       CH3COOH(aq) ⇄ H+(aq) + CH3COO-(aq)Keq = 1.8  x 10-5

(b)       H2O2(aq)    ⇄ H+(aq)+ HO2(aq)                                                    Keq = 2.6  x 10-12

(c)       CuSO4(aq)(+ Zn(s)   ⇄ Cu(s) + ZnSO4(aq)                                    Keq = 1037

18.       What effect will each of the following have **on the Keq** of the reaction shown below?

**2NO2(g)+ heat**⇄**N2O4(g)Keq = 2.2**

(a)       adding a catalyst

(b)       increasing the concentration of a reactant

(c)       increasing the concentration of a product

(d)       decreasing the volume

(e)       decreasing the pressure

(f)        increasing the temperature

(g)       decreasing the temperature