EQUILIBRIUM PROBLEMS

If you can determine the equilibrium concentrations of the chemicals involved in a reaction, then you can write an equilibrium expression and determine the value for the K_{eq} for that reaction.

For example let's use the following reaction:

$$2C0_{(g)} + 0_{2(g)} <===> 2C0_{2(g)}$$

Suppose that the equilibrium concentrations of the chemicals was found to be...

$[CO_{(g)}]$ = 0.2 moles/liter
$[0_{2(g)}]$ = 0.2 moles/liter
$[CO_{2(g)}]$ = .00075 moles/liter

The brackets [ ] around the formulas of the chemicals actually mean their concentration in moles/liter.

We can write the equilibrium expression for this reaction --- substitute the concentrations and solve for the equilibrium constant.

$$K_{eq} = \frac{[CO_2]^2}{[CO]^2[O_2]}$$

$$K_{eq} = \frac{[0.00075]^2}{[0.2]^2[0.2]}$$

$$K_{eq} = 7.03x10^{-5}$$

PRACTICE PROBLEMS

For each of the following reactions calculate the equilibrium constant. The equilibrium concentrations are given.

1. $2NO_{2(g)} <===> N_2O_{4(g)}$

   $[NO_{2(g)}]$ = 0.0045 moles/liter
   $[N_2O_{4(g)}]$ = .000005 moles/liter

2. $PCl_{5(g)} <===> PCl_{3(g)} + Cl_{2(g)}$

   $[PCl_{5(g)}]$ = 0.5 moles/liter
   $[PCl_{3(g)}]$ = 0.0075 moles/liter
   $[Cl_{2(g)}]$ = 0.0075 moles/liter

3. $H_{2(g)} + I_{2(g)} <===> 2HI_{(g)}$

   $[H_{2(g)}]$ = 4.5647×10^{-3} moles/liter
   $[I_{2(g)}]$ = 0.7378×10^{-3} moles/liter
   $[HI_{(g)}]$ = 13.544×10^{-3} moles/liter