Equilibrium Law Calculations

(with RICE charts)

- Read 566 (from "Calculating Kc…") to 568. Follow the sample calculation carefully.

Example 14.7 - pg. 567 $H_2 + I_2 \leftrightarrow 2HI$

	H_2	I_2	HI
R			
I			
C			
E			

Ratio, **I**nitial, **C**hange, **E**quilibrium

Q - Try PE 9 on pg. 568

PE 9 - pg. 568 $PCl_3 + Cl_2 \leftrightarrow PCl_5$

Q - Try 14.38, 14.39 pg. 589

Read 570-1. Follow sample calculation carefully.

14.9 - pg. 570 $CO + H_2O \leftrightarrow CO_2 + H_2$

	CO	H_2O	CO_2	H_2
R	1	1	1	1
I	0.100	0.100	0	0
C	-x	-x	+x	+x
E	0.10 - x	0.10 - x	x	x

$$Kc = \frac{[CO_2][H_2]}{[CO][H_2O]} = \frac{[x]^2}{[0.10 - x]^2} = 4.06$$

$x/[0.10-x] = 2.01$, $x = 0.201-2.01x$, $3.01x = 0.201$

$x=0.0668$

PE 11, 14.40, 14.41 pg. 589 (notice [ ] for 14.41)

Equilibrium calculations when Kc is very small

- Thus far, problems have been designed so that the solution for x is straightforward
- If the problems were not so carefully designed we might have to use quadratic equation (or calculus) to solve the problem.
- If Kc is very large or very small we can use a simplification to make calculating x simple
- Setting up the RICE chart is the same, but the calculation of Kc is now slightly different
- Read pg. 572, 573

Equilibrium calculations when Kc is small

Looking at the equilibrium law for 14.10:

$$\frac{4x^3}{[0.100 - 2x]^2} = \text{small Kc}$$

For Kc to be small, top must be small, bottom must be large (relative to top)

For top to be small, x must be small

If x is small, then $0.100 - 2x \cong 0.100$

Notice that we can only ignore x when it is in a term that is added or subtracted.

Can we ignore x in: $4x$, $3+x$, $0.1-3x$, $3x-x$, x^2+1?

We can for these:

Try PE 12 (573). Concentrations are [initial].

PE 12 - pg. 573 $N_2 + O_2 \leftrightarrow 2NO$

	N_2	O_2	NO
R			
I			
C			
E			

$2HCl \leftrightarrow H_2 + Cl_2$ $Kc= 3.2 \times 10^{-34}$

determine [equil], if [initial] are 2.0 M, 1.0 M, 0 M

	HCl	H_2	Cl_2
R			
I			
C			
E			