Name: Key
Blk:_____ Date:_____

Chemistry 12
EQUILIBRIUM Lesson #8
EQUILIBRIUM CALCULATIONS CONTINUED

EXAMPLE E

K_{eq} = 3.5 for $SO_2(g) + NO_2(g) \rightleftharpoons SO_3(g) + NO(g)$.

If 4.0 mol of $SO_2(g)$ and 4.0 mol of $NO_2(g)$ are placed in a 5.0 L bulb and allowed to come to equilibrium, what concentration of all species will exist at equilibrium?

1. Write out the keq expression

$$K_{eq} = \frac{[SO_3][NO]}{[SO_2][NO_2]}$$

2. Solve for the [ ]'s of substances given in the question.

$$[SO_2]_I = \frac{4.0\,mol}{5.0\,L} = 0.80\,M \quad ; \quad [NO_2]_I = \frac{4.0\,mol}{5.0\,L} = 0.80\,M$$

3. B/C there is a sense of "TIME PASSING" we need an ICE TABLE

	$SO_2(g)$	+ $NO_2(g)$	$\rightleftharpoons$ $SO_3(g)$	+ $NO(g)$
I	0.80	0.80	∅	∅
+ C	−x	−x	+x	+x
E	0.80−x	0.80−x	+x	x

4. First use keq expression to solve for x

$$3.5 = \frac{(x)(x)}{[0.80-x][0.80-x]} \Rightarrow \sqrt{\frac{x^2}{(0.80-x)^2}} = \sqrt{3.5}$$

$$\frac{x}{0.80-x} = (1.871)(0.80-x) \rightarrow x = 1.496 - 1.871x + 1.871x$$

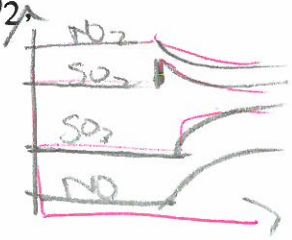
$$\therefore 2.871x = 1.496 \rightarrow$$

EXAMPLE F: *Think of LeChatelier graphs*

A 1.0 L reaction vessel contained 1.0 mol of SO_2, 4.0 mol of NO_2, 4.0 mol of SO_3 and 4.0 mol of NO at equilibrium according to:

$SO_2\ (g) + NO_2\ (g) \rightleftharpoons SO_3\ (g) + NO\ (g)$.

If 3.0 mol of SO_2 is added to the mixture, what will be the new concentration of NO when equilibrium is re-attained?



1. Write out the Keq expression $K_{eq} = \frac{[SO_3][NO]}{[SO_2][NO_2]}$

2. Use equilibrium [ ]'s to solve for Keq

$K_{eq} = \frac{[4.0][4.0]}{[1.0][4.0]} = 4.0$

$[SO_2]_E = \frac{1.0\,mol}{1.0\,L} = 1.0M$ (3.0 mol + 1.0 L)

$[NO_2]_E = \frac{4.0\,mol}{1.0\,L} = 4.0M$

Bc there is no change in temp, the NEW EQUILIBRIUM will also be 4.0!

3. The Addition of 3.0 mol will be shown in the [I] (In the ICE TABLE)

	$SO_2(g)$	+ $NO_2(g)$	$\rightleftharpoons$ $SO_3(g)$	+ $NO(g)$
			4.0	4.0
I	4.0 + 1.0 + 3.0	4.0		
C	−X	−X	+X	+X
E	4.0 − X	4.0 − X	4.0 + X	4.0 + X

4. Use $K_{eq} = 4.0$ and Equilibrium [ ]'s to solve for X!

$\sqrt{4.0} = \sqrt{\frac{(4.0+X)^2}{(4.0-X)^2}} = 2.0 = \frac{4.0+X}{4.0-X} \times (4.0-X)$

$2.0(4.0-X) = 4.0 + X$

$8.0 - 2.0X = 4.0 + X$

$\frac{8.0-4.0}{3.0} = \frac{3.0X}{3.0}$

$1.33 = X$

SEAT WORK/HOMEWORK: Exercises 55-65 pgs 71-72

PLO F8 (PLEASE NOTE that we have NOT COVERED: PLO's D2, D3 and E3)