Equilibrium #7

1. $CO_{(g)} + H_2O_{(g)} \longleftrightarrow CO_{2(g)} + H_{2(g)}$

$$K_{eq} = \frac{[CO_2][H_2]}{[CO][H_2O]} = 4.0$$

$$K_{eq} = \frac{(0.10 + x)(0.10)}{(0.20)(0.20)} = 4.0$$

	CO	H_2O	CO_2	H_2
[Initial]	0.10	0.10	0.20	0.20
change	+0.10	+0.10	+x -0.10	-0.10
[Eq=]	0.20	0.20	0.10 + x	0.10

$x = 1.5\ M$ # of moles = $1.5\ M \times 2.0\ L$ = 3.0 mols CO_2 added.

2. $2NO_{(g)} + O_{2(g)} \leftrightarrow 2NO_{2(g)}$

$$K_{eq} = \frac{[NO_2]^2}{[NO]^2[O_2]}$$

$$K_{eq} = \frac{(0.12)^2}{(0.10)^2(0.020)} = 72.$$

	NO	O_2	NO_2
[Initial]	0.30/5.0	0	0.80/5.0
change	+0.040	+0.020	-0.040
[Eq=]	0.10	0.020	0.12

3. $2NO_{(g)} + Cl_{2(g)} \longleftrightarrow 2NOCl_{(g)}$

$$K_{eq} = \frac{[NOCl]^2}{[NO]^2[Cl_2]}$$

$$K_{eq} = \frac{(.12)^2}{(.28)^2(.34)} = 0.54$$

	NO	Cl_2	NOCl
[Initial]	2.00/5.0	2.00/5.0	0
change	-.12	-.06	+.12
[Eq=]	.28	.34	.12

4. $A_{2(g)} + B_{2(g)} \longleftrightarrow 2AB_{(g)}$

$$K_{eq} = \frac{[AB]^2}{[A_2][B_2]}$$

	A_2	B_2	AB
[Initial]	0.200	0.200	0.400
change	+ x	+ x	+0.100 - 2x
[Eq=]	0.200 + x	0.200 + x	0.500 - 2x

$$K_{eq} = \frac{(0.400)^2}{(0.200)(0.200)} = 4.00$$

$$K_{eq} = \frac{(0.500 - 2x)^2}{(0.200 + x)^2} = 4.00$$ take square root of both sides.

$$\frac{0.500 - 2x}{0.200 + x} = 2.00 \qquad x = 0.0250M$$

new [AB] = 0.500 - 2(0.0250) = 0.450M

Key

Equilibrium #7

5. $C_2 + D_2 \longleftrightarrow 2CD$

$$K_{eq} = \frac{[CD]^2}{[C_2][D_2]} = 9.0 \times 10^{-2}$$

$$K_{eq} = \frac{(2x)^2}{(0.24 - x)^2} = 9.0 \times 10^{-2}$$

	C_2	D_2	CD
[Initial]	0.24	0.24	0
change	$-x$	$-x$	$+2x$
[Eq =]	$0.24 - x$	$0.24 - x$	$2x$

take the square root of both sides

$$\frac{2x}{0.24 - x} = 0.30 \qquad x = 0.0313$$

$[C_2]$ at eq = $0.24 - 0.0313 = \underline{\underline{0.21\ M}}$