PRACTICE: EQUILIBRIUM CALCULATIONS 4
SOLUTIONS

1.

$COCl_2(g) \rightleftharpoons CO(g) + Cl_2(g) \quad K = 2.2\times10^{-8}$

	$COCl_2$	CO	Cl_2
I	1.5	0	0
C	$-x$	$+x$	$+x$
E	$1.5-x$	x	x

$$K = \frac{[CO][Cl_2]}{[COCl_2]}$$

$$2.2\times10^{-8} = \frac{(x)(x)}{1.5-x}$$

$$2.2\times10^{-8} \doteq \frac{x^2}{1.5} \quad (\text{assume } 1.5-x = 1.5)$$

$$x = \sqrt{1.5\,(2.2\times10^{-8})}$$

$$= 1.81659...\times10^{-4}$$

$$[Cl_2]_{eq} = x \text{ mol/L}$$

$$= 1.8\times10^{-4} \text{ mol/L}$$

2.

$N_2(g) + O_2(g) \rightleftharpoons 2\,NO(g) \quad K = 1.0\times10^{-5}$

	N_2	O_2	NO
I	0.104	0.028	0
C	$-x$	$-x$	$+2x$
E	$0.104-x$	$0.028-x$	$2x$

$$K = \frac{[NO]^2}{[N_2][O_2]}$$

$$1.0\times10^{-5} = \frac{(2x)^2}{(0.104-x)(0.028-x)}$$

$$1.0\times10^{-5} = \frac{4x^2}{(0.104)(0.028)} \quad \left\{\begin{array}{l}\text{assume}\\ 0.104-x = 0.104\\ 0.028-x = 0.028\end{array}\right.$$

$$x = \sqrt{\frac{1.0\times10^{-5}(0.104)(0.028)}{4}}$$

$$= 8.53229...\times10^{-5}$$

$$[NO]_{eq} = 2x \text{ mol/L}$$

$$= 2\,(8.53229...\times10^{-5}) \text{ mol/L}$$

$$= 1.7\times10^{-4} \text{ mol/L}$$