Chapter 14 Multiple Choice Numerical Solutions

3. $Rxn_2 = 2(Rxn_1)$

$$K_{c,2} = \left(K_{c,1}\right)^2 = \left(4.4\times10^{9}\right)^2 = 1.9\times10^{19}$$

6.

$$\left[N_2O_4\right]_0 = \frac{0.625\,M}{5.00\text{ L}} = 0.125\,M$$

Since $\left[N_2O_4\right]_{eq} = 0.075\,M$, let $x = 0.125\,M - 0.075\,M = 0.050\,M$ and $2x = 0.10\,M$

Thus, $\left[NO_2\right]_{eq} = 2\times0.050\,M = 0.10\,M$

Using ICE:

	$2\ NO_2\ (g)$	$\rightleftharpoons$	$N_2O_4\ (g)$
Initial (M)	0		0.125
Change (M)	+0.10		–0.050
Equilibrium (M)	0.10		0.075

$$K_C = \frac{0.075}{0.10^2} = 7.5$$

7. Set up ICE:

	$2NO_2\ (g)$	$\rightleftharpoons$	$2NO\ (g)$	+	$O_2\ (g)$
Initial (atm)	0.500		0		0
Change (atm)	–2x		+2x		+x
Equilibrium (atm)	0.500 – 2x		2x		x

So the $P_{Total} = (0.500 - 2x) + 2x + x = 0.674$ atm

x = 0.174 atm

$$P_{NO_2} = 0.500\text{ atm} - 2\times0.174\text{ atm} = 0.152\text{ atm}$$

9. The desired rxn = ½ rxn_2 – ½ rxn_1, so

$$K_C = \left(K_{C,2}\right)^{\frac{1}{2}}\left(K_{C,1}\right)^{-\frac{1}{2}} = \left(\frac{1.4\times10^{-3}}{2.3\times10^{-7}}\right)^{\frac{1}{2}} = \sqrt{6100} = 78$$

10. Solve Q_C:

$$Q_C = \frac{\left[SO_3\right]^2}{\left[SO_2\right]^2\left[O_2\right]} = \frac{\left(0.10\right)^2}{\left(10.\right)^2\left(0.1\right)} = \frac{10^{-2}}{10^{1}} = 10^{-3}$$

So, $Q_C < K_C$ and the equilibrium will shift to the right

16. Set up ICE:

	$2NOCl\ (g)$	$\rightleftharpoons$	$2NO\ (g)$	+	$Cl_2\ (g)$
Initial (M)	y		0		0
Change (M)	–2x		+2x		+x
Equilibrium (M)	1.00		2x		x

$$K_C = \frac{\left[2x\right]^2\left[x\right]}{\left[1.00\right]^2} = 8.0 \text{ so } 4x^3 = 8.0 \text{ and } x = \sqrt[3]{2.0} = 1.26$$

$[NOCl]_0$ = y = 1.00 M + 2x = 1.00 M + 2×1.26 M = 3.52 M

18. $2H_2S\ (g) \rightleftharpoons 2H_2\ (g) + S_2\ (g)$

$P_{S_2} = \frac{1}{2}P_{H_2} = \frac{1}{2}(0.300\ \text{atm}) = 0.150\ \text{atm}$

$K_P = \dfrac{P_{H_2}^2 P_{S_2}}{P^2_{H_2S}} = 0.0120;\ P_{H_2S} = \sqrt{\dfrac{P_{H_2}^2 P_{S_2}}{0.0120}} = \sqrt{\dfrac{(0.300)^2(0.150)}{0.120}} = 1.06\ \text{atm}$

$P_{Total} = 1.06\ \text{atm} + 0.300\ \text{atm} + 0.150\ \text{atm} = 1.51\ \text{atm}$