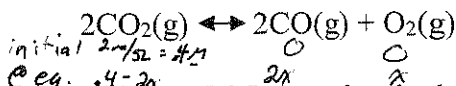


Equilibrium Review #2

1. At a particular temperature, $K = 2.0 \times 10^{-6}$ for the reaction:



If 2.0 mol CO_2 is initially placed into a 5.0 L vessel, calculate the equilibrium concentrations of all species.

$$2 \times 10^{-6} = \frac{(2x)^2(x)}{(0.4 - 2x)^2}$$

$$2 \times 10^{-6} = \frac{4x^3}{-16}$$

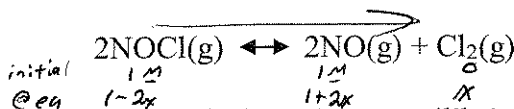
$$x = 0.0043 \text{ M}$$

$$[\text{CO}_2] = 0.4 - 2(0.0043) = 0.39 \text{ M CO}_2$$

$$[\text{CO}] = 2(0.0043) = 0.0086 \text{ M CO}$$

$$[\text{O}_2] = 0.0043 \text{ M O}_2$$

2. At 35°C , $K = 1.6 \times 10^{-5}$ for the reaction below.



Calculate the concentration of all species at equilibrium when 1.0 mol NOCl and 1.0 mol NO is initially put in a 1 L flask.

$$1.6 \times 10^{-5} = \frac{(1 + 2x)^2(x)}{(1 - 2x)^2}$$

$$x = 1.6 \times 10^{-5}$$

$$[\text{NOCl}] = 1 - 2(1.6 \times 10^{-5}) = 1 \text{ M NOCl}$$

$$[\text{NO}] = 1 \text{ M NO}$$

$$[\text{Cl}_2] = 1.6 \times 10^{-5} \text{ M Cl}_2$$

3. At a particular temperature, the reaction below is at equilibrium when the concentrations of SO_2 and NO_2 are both 1.28 M and the concentrations of SO_3 and NO are both 2.47 M in a 6.3 L container. What will be the new concentrations of all gases at equilibrium if 2.5 mols of SO_3 is added into the reaction.

$$\text{SO}_2(\text{g}) + \text{NO}_2(\text{g}) \leftrightarrow \text{SO}_3(\text{g}) + \text{NO}(\text{g})$$

	<i>initial</i>	1.28 M	1.28 M	2.47 M	2.47 M	
	<i>@ eq.</i>	$1.28 - x$	$1.28 - x$	$2.47 + x$	$2.47 + x$	

$+ 2.5 \text{ mols} \rightarrow 0.4\text{ M}$

$$K = \frac{(2.47)^2}{(1.28)^2} = 3.72$$

$$3.72 = \frac{(2.87 - x)(2.47 + x)}{(1.28 + x)(1.28 + x)}$$

$$3.72 = \frac{7.0889 - 5.34x + x^2}{1.6384 + 2.56x + x^2}$$

$$6.0948 + 9.523x + 3.72x^2 = 7.0889 - 5.34x + x^2$$

$$2.72x^2 + 14.8632x - .994 = 0$$

$$x = 0.066$$

$[\text{SO}_2] = 1.346 \text{ M SO}_2$
 $[\text{NO}_2] = 1.346 \text{ M NO}_2$
 $[\text{SO}_3] = 2.804 \text{ M SO}_3$
 $[\text{NO}] = 2.404 \text{ M NO}$

initial 1.28 M 1.28 M 2.87 M 2.47 M

@ eq. $1.28 + x$ $1.28 + x$ $2.87 - x$ $2.47 - x$

4. The reaction below was analyzed at equilibrium and found to have concentrations of N_2 and H_2 were both 3 M. What is the concentration of NH_3 if the K value for this reaction is 0.016.

