Chemistry 12

Worksheet for K_{eq} calculations

1. Write the expression for the equilibrium constant for each of the following reactions.

(a) $H_{2(g)} + Cl_{2(g)} \Leftrightarrow 2\,HCl_{(g)}$

$K_{eq} =$

(b) $2\,SO_{2(g)} + O_{2(g)} \Leftrightarrow 2\,SO_{3(g)}$

$K_{eq} =$

(c) $N_{2(g)} + 3\,H_{2(g)} \Leftrightarrow 2\,NH_{3(g)}$

$K_{eq} =$

(d) $2\,CO_{(g)} + O_{2(g)} \Leftrightarrow 2\,CO_{2(g)}$

$K_{eq} =$

(e) $CaCO_{3(s)} \Leftrightarrow CaO_{(s)} + CO_{2(g)}$

$K_{eq} =$

(f) $HCN_{(g)} \Leftrightarrow H^{+}_{(aq)} + CN^{-}_{(aq)}$

$K_{eq} =$

(g) $H_2SO_{4(l)} \Leftrightarrow H^{+}_{(aq)} + HSO_4^{-}{}_{(aq)}$

$K_{eq} =$

(h) $H_2CO_{3(aq)} \Leftrightarrow 2\,H^{+}_{(aq)} + CO_3^{2-}{}_{(aq)}$

$K_{eq} =$

2. From selected equilibrium constant expressions above, calculate the value of the equilibrium constant (K_{eq}).

(a) from 1(a) above: equilibrium $[H_2] = [Cl_2] = [HCl] = 1.0 \times 10^{-2}$ M

(b) from 1(b) above: equilibrium $[SO_2] = 1.0 \times 10^{-3}$ M
$[O_2] = 2.0 \times 10^{-3}$ M
$[SO_3] = 3.0 \times 10^{-3}$ M

(c) from 1(c) above: equilibrium $[N_2] = 4.4 \times 10^{-2}$ M
$[H_2] = 1.2 \times 10^{-1}$ M
$[NH_3] = 3.4 \times 10^{-3}$ M

3. From 1(a) above, assume the equilibrium constant to be 55.0. During an experiment, the equilibrium $[H_2] = 4.8 \times 10^{-3}$ M and $[Cl_2] = 2.1 \times 10^{-3}$ M. What is the equilibrium [HCl]?

4. Under a given set of experimental conditions, the reaction;

$$N_{2(g)} + O_{2(g)} \Leftrightarrow 2\,NO_{(g)}$$

has a $K_{eq} = 6.2 \times 10^{-4}$. If the equilibrium $[N_2] = [O_2] = 5.2$ M, then what is the equilibrium [NO]?

5. According to 1(b) above, if 0.600 mole of SO_2 and 0.600 mole of O_2 are placed into a 1.00 L container and allowed to establish equilibrium, the equilibrium $[SO_3] = 0.500$ M. Calculate the value of K_{eq}.

Must use an ICE box to calculate the equilibrium values of SO_2 and O_2

K_{eq} =

	$2\,SO_2$ +	O_2	$\Leftrightarrow$ $2\,SO_3$
I			
C			
E			

6. Under a given set of experimental conditions, the reaction;

$$2\,HI_{(g)} \Leftrightarrow H_{2(g)} + I_{2(g)}$$

has a $K_{eq} = 2.4$. If the initial [HI] = 0.200 M, then what are the equilibrium concentrations of all of the chemicals in the reaction?

	$2\,HI$	$\Leftrightarrow$	H_2	+	I_2
I					
C					
E					

K_{eq} =