Equilibrium Part 1 Practice Quiz

Key

1. Write the mass action expression and calculate the Keq value for the following equation with the listed concentrations. $CH_4(g) + H_2O(g) \leftrightarrow CO(g) + 3\ H_2(g)$

   $[CH_4] = 2 \times 10^{-3}$ M $[H_2O] = 7 \times 10^{-3}$ M

   $[CO] = 5 \times 10^{-3}$ M $[H_2] = 3 \times 10^{-3}$ M

$K_{eq} = \frac{[CO][H_2]^3}{[CH_4][H_2O]} = \frac{(5\times10^{-3})(3\times10^{-3})^3}{(2\times10^{-3})(7\times10^{-3})} = 9.64 \times 10^{-6}$

2. What is the concentration of O_2 if Keq = 6.5×10^{-8} and the concentrations of H_2 and H_2O are both 0.7M?

   $O_{2(g)} + 2H_{2(g)} \leftrightarrow 2H_2O_{(l)}$ ← liquid

$K_{eq} = \frac{1}{[O_2][H_2]^2}$

$6.5\times10^{-8} = \frac{1}{[O_2](0.7)^2}$

$[O_2] = \frac{1}{(6.5\times10^{-8})(0.7)^2}$

$[O_2] = 3.14 \times 10^7$ M

3. What is the concentration of HI if Keq = 4.0×10^3 and the concentrations of H_2 and I_2 are 0.25M and 1.0M respectively?

   $H_{2(g)}\ I_{2(g)} \leftrightarrow 2HI_{(g)}$

$K_{eq} = \frac{[HI]^2}{[H_2][I_2]}$

$4.0\times10^3 = \frac{[HI]^2}{(0.25)(1.0)}$ $[HI]^2 = 1000$

$[HI] = 31.62$ M

4. An equilibrium system was kept at constant temperature and pressure in a **five litre** container. It contained 0.15 mole of SO_2 , 0.25 mole of NO_2 , 0.40 mole of NO, and 0.50 mole of SO_3. What is the equilibrium constant for the following reaction?

   $SO_3\ (g)\ +\ NO\ (g)\ <=>\ SO_2\ (g)\ +\ NO_2\ (g)$

$K_{eq} = \frac{[SO_2][NO_2]}{[SO_3][NO]} = \frac{(0.03)(0.05)}{(0.1)(0.08)} = 0.1875$

5. For the reaction:

$H_2(g) + F_2(g) \leftrightarrow 2HF(g)$ $K = 3 \times 10^{-4}$

Find the equilibrium concentration of HF in a 1.00 L container if initially there were 0.200 moles of H_2 added to 0.200 moles of F_2.

	H_2	F_2	$\leftrightarrow 2HF$
I	0.200	0.200	0
C	$-x$	$-x$	$+2x$
E	$0.200-x$	$0.200-x$	$2x$

$K_{eq} = 3 \times 10^{-4}$

$K_{eq} = \frac{[HF]^2}{[H_2][F_2]}$

$3.0 \times 10^{-4} = \frac{(2x)^2}{(0.200-x)^2}$

$0.0173 = \frac{2x}{0.200-x}$

$0.0173(0.200-x) = 2x$

$3.46 \times 10^{-3} - 0.0173x = 2x$

$3.4 \times 10^{-3} = 2.0173x$

$x = 1.7151 \times 10^{-3}$

$[HF] = 3.43 \times 10^{-3}\ m$

$[H_2] + [F_2] = 0.1983\ m$

6. Initially the concentrations of N_2 and O_2 are 1.4 mol/L each and there is 0.1 mol/L of NO. If at equilibrium the [NO] is 2.0 mol/L, find K.

$N_2(g) + O_2(g) \leftrightarrow 2\ NO(g)$

	N_2	$+ O_2$	$\rightleftharpoons 2NO$
I	1.4M	1.4M	0.1M
C	$-x$	$-x$	$+2x$
E	0.45M	0.45M	2.0M

$1.9 = 2x$

$0.95 = x$

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

$K_{eq} = \frac{(2.0)^2}{(0.45)(0.45)}$

$K_{eq} = 19.75$