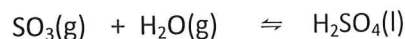


Equilibrium Calculations

Honors Chemistry

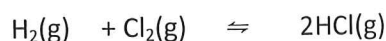
1. Write the expression and calculate the K_{eq} :



- $[\text{SO}_3] = 0.400\text{-M}$, $[\text{H}_2\text{O}] = 0.480\text{-M}$, $[\text{H}_2\text{SO}_4] = 0.600\text{-M}$

$$K_{eq} = \frac{1}{[\text{SO}_3]^1 \times [\text{H}_2\text{O}]^1} = \frac{1}{[.40]^1 \times [.48]^1} = \boxed{5.21}$$

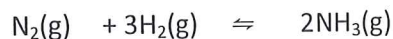
2. Write the expression and calculate the K_{eq} :



- $[\text{H}_2] = 0.010\text{-M}$, $[\text{Cl}_2] = 0.010\text{-M}$, $[\text{HCl}] = 0.0001\text{-M}$

$$K_{eq} = \frac{[\text{HCl}]^2}{[\text{H}_2]^1 \times [\text{Cl}_2]^1} = \frac{[.0001]^2}{[.01]^1 \times [.01]^1} = \boxed{.0001}$$

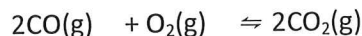
3. Write the expression and calculate the K_{eq} :



- $[\text{N}_2] = 0.044\text{-M}$, $[\text{H}_2] = 0.012\text{-M}$, $[\text{NH}_3] = 0.0034\text{-M}$

$$K_{eq} = \frac{[\text{NH}_3]^2}{[\text{N}_2] \times [\text{H}_2]^3} = \frac{[.0034]^2}{[.044]^1 \times [.012]^3} = \boxed{152.0}$$

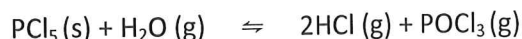
4. Write the expression and calculate the K_{eq} :



- $[\text{CO}] = 0.5\text{-M}$, $[\text{O}_2] = 0.5\text{-M}$, $[\text{CO}_2] = 2.5\text{-M}$

$$K_{eq} = \frac{[\text{CO}_2]^2}{[\text{CO}]^2 \times [\text{O}_2]} = \frac{[2.5]^2}{[.5]^2 \times [.5]} = \boxed{50}$$

5. Write the expression and calculate the K_{eq} :

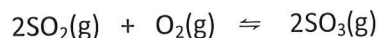


- a 2.0-L flask contains 0.075 mol of PCl_5 , 0.050 mol of H_2O , 0.750 mol of HCl , and 0.500 mol of POCl_3

$$K_{eq} = \frac{[\text{HCl}]^2 \times [\text{POCl}_3]}{[\text{H}_2\text{O}]} = \frac{[.375]^2 \times [.25]^1}{[.025]} = \boxed{1.41}$$

Find M
 $\text{HCl} = .375\text{-M}$
 $\text{POCl}_3 = .25\text{-M}$
 $\text{H}_2\text{O} = .025\text{-M}$

6. At 25°C, the $K_{eq} = 798$ for the following reaction:



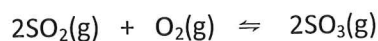
- Calculate the equilibrium concentration of $[O_2]$ in a container of $[SO_2] = 4.20\text{-M}$ and $[SO_3] = 11.0\text{-M}$

$$K_{eq} = \frac{[SO_3]^2}{[SO_2]^2 \times [O_2]} \quad \left\{ \quad 798 = \frac{[11.0]^2}{[4.20]^2 \times [O_2]} \right.$$

$$O_2 = \frac{[11.0]^2}{798 \times [4.20]^2}$$

$$O_2 = .0086\text{-M}$$

7. At 100°C, the $K_{eq} = 680$ for the following reaction:



- Calculate the equilibrium concentration of $[SO_3]$ in a 4.0-L container with 0.6 mol of SO_2 and 0.6 mol of O_2

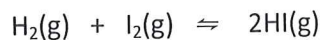
$$\left. \begin{array}{l} \text{Molarity} \\ SO_3 = ? \\ SO_2 = .15\text{-M} \\ O_2 = .15\text{-M} \end{array} \right\} \quad 680 = \frac{[SO_3]^2}{[.15]^2 \times [.15]}$$

$$[SO_3]^2 = 680 \times [.15]^2 \times [.15]$$

$$[SO_3]^2 = 2.295$$

$$SO_3 = 1.51\text{-M}$$

8. At 250°C, the $K_{eq} = 55.6$ for the following reaction:



- Calculate the equilibrium concentration of $[HI]$ in a container of $[H_2] = 0.20\text{-M}$ and $[I_2] = 0.20\text{-M}$

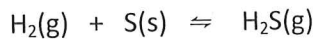
$$55.6 = \frac{[HI]^2}{[H_2] \times [I_2]} = \frac{[HI]^2}{[.2] \times [.2]}$$

$$[HI]^2 = 55.6 \times [.2] \times [.2]$$

$$[HI]^2 = 2.224$$

$$HI = 1.49\text{-M}$$

9. At a certain temperature, the $K_{eq} = 14$ for the following reaction:



- Calculate the equilibrium concentration of $[H_2]$ in a 2.0-L container with 0.6 mol of H_2S and 1.4 mol of S

$$\left. \begin{array}{l} \text{Molarity} \\ H_2S = .3\text{-M} \\ S = \text{Solid} \end{array} \right\} \quad 14 = \frac{[H_2S]}{[H_2]} = \frac{[.3]}{[H_2]}$$

$$[H_2] = \frac{[.3]}{14}$$

$$H_2 = .02\text{-M}$$

10. At 100°C, the $K_{eq} = 1.47 \times 10^{-3}$ for the following reaction:



- Calculate the equilibrium concentration of $[SO_3]$ in a 2.0-L container with 4.0 mol of SO_2 and 5.0 mol of O_2

$$\left. \begin{array}{l} \text{Molarity} \\ SO_3 = ? \\ SO_2 = 2.0\text{-M} \\ O_2 = 2.5\text{-M} \end{array} \right\} \quad 1.47 \times 10^{-3} = \frac{[SO_2]^2 \times [O_2]}{[SO_3]^2}$$

$$= \frac{[2.0]^2 \times [2.5]}{[SO_3]^2}$$

$$[SO_3]^2 = \frac{[2.0]^2 \times [2.5]}{1.47 \times 10^{-3}}$$

$$[SO_3]^2 = 6802.7$$

$$SO_3 = 82.5\text{-M}$$