# The Reaction Quotient (Q)
Chem Worksheet 18-4

Name _____

Answer the following questions about equilibrium.

1. At 740°C, $K_{eq} = 0.0060$ for the decomposition of calcium carbonate ($CaCO_3$). Find Q and predict how the reaction will proceed if $[CO_2] = .0004 M$.

$$CaCO_3 \text{ (s)} \leftrightarrows CaO \text{ (s)} + CO_2 \text{ (g)}$$

2. The equilibrium constant for the following reaction at 527°C is 5.10. If $[CO] = 0.15\ M$, $[H_2O] = 0.25\ M$, $[H_2] = 0.42\ M$, and $[CO_2] = 0.37\ M$, calculate Q and determine how the reaction will proceed.

$$CO \text{ (g)} + H_2O \text{ (g)} \leftrightarrows H_2 \text{ (g)} + CO_2 \text{ (g)}$$
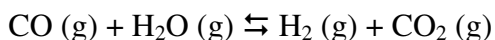
3. At 340°C, $K_{eq} = 0.064$ for the reaction of rust with hydrogen gas. Given the $[H_2] = 0.45\ M$ and $[H_2O] = 0.37\ M$, find Q and predict how the reaction will proceed.

$$Fe_2O_3 \text{ (s)} + 3H_2 \text{ (g)} \leftrightarrows 2Fe \text{ (s)} + 3H_2O \text{ (g)}$$
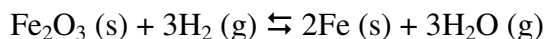
4. The equilibrium constant for the following reaction at 2130°C is 0.0025. If $[N_2] = 0.81\ M$, $[O_2] = 0.75\ M$, and $[NO] = 0.030\ M$, find Q and determine the direction in which the reaction will proceed.

$$N_2 \text{ (g)} + O_2 \text{ (g)} \leftrightarrows 2NO \text{ (g)}$$
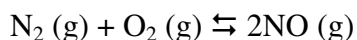
5. At 500°C, the equilibrium constant for the following reaction is 0.080. Given that $[NH_3] = 0.0596\ M$, $[N_2] = 0.600\ M$, and $[H_2] = 0.420\ M$, find Q and predict how the reaction will proceed.

$$N_2 \text{ (g)} + 3H_2 \text{ (g)} \leftrightarrows 2NH_3 \text{ (g)}$$
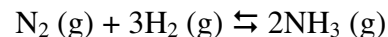
6. For the decomposition of antimony pentachloride ($SbCl_5$) $K_{eq} = 0.0251$. What is the value of Q if $[SbCl_5] = 0.095\ M$, $[SbCl_3] = 0.020\ M$, and $[Cl_2] = 0.050\ M$? How will this reaction proceed?

$$SbCl_5 \text{ (g)} \leftrightarrows SbCl_3 \text{ (g)} + Cl_2 \text{ (g)}$$

7. At 1000°C, $K_{eq} = 1.0 \times 10^{-13}$ for the following reaction. If $[HF] = 23.0\ M$, $[H_2] = 0.540\ M$, and $[F_2] = 0.38\ M$, determine the value of Q and predict how the reaction will proceed.

$$2HF \text{ (g)} \leftrightarrows H_2 \text{ (g)} + F_2 \text{ (g)}$$
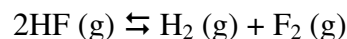
8. At 1227 °C, K_{eq} for the following reaction is 0.15. If $[SO_2] = 0.344\ M$, $[O_2] = 0.172\ M$, and $[SO_3] = 0.056\ M$, find Q and determine how the reaction will proceed.

$$2SO_2 \text{ (g)} + O_2 \text{ (g)} \leftrightarrows 2SO_3 \text{ (g)}$$