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*.

$$CaCO_3\ (s) \leftrightarrows CaO\ (s) + CO_2\ (g)$$

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.

$$CO\ (g) + H_2O\ (g) \leftrightarrows H_2\ (g) + CO_2\ (g)$$

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.

$$Fe_2O_3\ (s) + 3H_2\ (g) \leftrightarrows 2Fe\ (s) + 3H_2O\ (g)$$

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.

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

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.

$$N_2\ (g) + 3H_2\ (g) \leftrightarrows 2NH_3\ (g)$$

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?

$$SbCl_5\ (g) \leftrightarrows SbCl_3\ (g) + Cl_2\ (g)$$

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.

$$2HF\ (g) \leftrightarrows H_2\ (g) + F_2\ (g)$$

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.

$$2SO_2\ (g) + O_2\ (g) \leftrightarrows 2SO_3\ (g)$$