The Reaction Quotient

1. What is Q, the reaction quotient?

   It is a value that indicates the direction a reaction will shift in order to achieve equilibrium.

   Think of Q as the star on a map that tells you where you are and K represents where you want to be.

2. What is the expression for Q?

$$aA + bB \rightleftharpoons cC + dD$$

$$Q = \frac{[C]^c [D]^d}{[A]^a [B]^b}$$

3. What is the difference between Q and K?

   Only equilibrium concentrations or partial pressures may be plugged into the expression for K. The concentrations or partial pressures from any point of the reaction may be plugged into the expression for Q.

4. How is Q helpful?

   When compared to K, Q can indicate the direction a reaction will shift in order to reach equilibrium.

   If…

$K = Q$	*reaction is at equilibrium*
$K < Q$	*reaction has too much product. Reaction shifts left in order to bring concentrations/partial pressures of product down and reactant up. Notice that the < points in the direction of the reaction shift.*
$K > Q$	*reaction has too much reactant. Reactions shifts right in order to bring concentration/partial pressures of reactant down and product up. Notice that > points in the direction of the reaction shift.*

5. Consider:

$$A + B \rightleftharpoons C + D \qquad K=10$$

If [A] = 2M, [B] = 4M, [C] = 1M and [D] = 8M, in what direction will a reaction shift to reach equilibrium?

$$Q = \frac{(1)(8)}{(2)(4)} = 1$$

$K > Q$ **shifts right.**