LeChatelier and Concentration

When a system is at equilibrium, Q = K. Changing the concentration of reactants or products that are part of the equilibrium constant expression cause the reactant quotient, Q, to change. Q will no longer be equal to K and the system will seek to restore itself to a new equilibrium that offsets the change.

For example: **Adding reactant** to an equilibrium system.

$2\ NO_2(g)\ \text{<--->}\ N_2O_4(g)$ ..... $K_c = [N_2O_4] / [NO_2]^2$

Adding $NO_2(g)$ will cause the reaction to run in the forward direction to **consume the added reactant**. Since NO_2 is in the denominator, Q is less than K, and more product needs to be produced to reestablish equilibrium. Therefore the concentration of N_2O_4 (g) will increase.

$2\ H_2O(l)\ \text{<--->}\ 2\ H_2(g) + O_2(g)$ ..... $K_c = [H_2]^2\ [O_2]$

Adding $H_2O(l)$ will have **no effect** on the equilibrium because the reactant is a liquid. Notice that the concentration of $H_2O(l)$ is not a part of the equilibrium constant expression. Since the concentration of product gases do not change when $H_2O(l)$ is added, Q is still equal to K and there is no driving force for the system to change. As long as some liquid is present to establish the equilibrium, adding more will have no effect on the concentration of products.