**Unit:** Kinetics

### Knowledge/Understanding:

* relate the rate of reaction to the equilibrium constant and the activation energy of the reaction

chemical equilibrium: when a chemical reaction in the forward direction is happening at the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as the chemical reaction in the reverse direction; when the overall concentrations or partial pressures of chemicals in a reaction are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

equilibrium constant (Keq): a number that relates the forward and reverse rates of reaction. If K = 1, the forward and reverse rates are \_\_\_\_\_\_\_\_\_\_. If K > 1, then the forward reaction is \_\_\_\_\_\_\_\_\_\_\_\_ than the reverse reaction. If K < 1, then the reverse reaction is \_\_\_\_\_\_\_\_\_\_\_\_\_.

## Kinetics and the Equilibrium Constant

Consider the following reaction:

N2 (g) + 3 H2 (g)  2 NH3 (g)

The rate laws for the forward and reverse reactions are:

forward: Rf =

reverse: Rr =

At equilibrium, Rf = Rr, which means:

Using algebra, we can get the rate constants on one side of the equation and the concentration terms on the other:

Notice that this is exactly identical with the equilibrium expression:

Therefore,

In general, for a reaction:

aA + bB → cC +dD