Reaction Mechanisms

Nearly all chemical reactions happen in a series of elementary steps. These steps are called the reaction mechanism. Reaction mechanisms are comprised of elementary steps, which are called that because the rate law for an elementary reaction is the same as the molecularity. Molecularity is defined as the number of species that must collide for the reaction to happen as written.

For a proposed mechanism to be possibly correct it needs to meet two criteria:

1- The sum of the elementary steps must equal the overall reaction.

2- The mechanism must agree with the experimental rate law.

$$\mathrm{NO_{2(g)} + CO_{(g)} \rightarrow NO_{(g)} + CO_{2(g)}} \qquad \mathrm{Rate} = k[\mathrm{NO_2}]^2$$

$$\mathrm{NO_{2(g)} + NO_{2(g)} \rightarrow NO_{3(g)} + NO_{(g)}} \qquad \mathrm{Rate} = k[\mathrm{NO_2}]^2$$

$$\mathrm{NO_{3(g)} + CO_{(g)} \rightarrow NO_{2(g)} + CO_{2(g)}} \qquad \mathrm{Rate} = k[\mathrm{NO_3}][\mathrm{CO}]$$

Ex: