# Answer on Question #41805 - Chemistry - Inorganic Chemistry
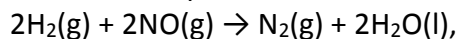
**Question:**
(a) The reaction between hydrogen, $H_2(g)$, and nitrogen monoxide, $NO(g)$, has the following rate equation,
rate = $k[H_2(g)][NO(g)]^2$,
The overall equation for the reaction is,
$2H_2(g) + 2NO(g) \rightarrow N_2(g) + 2H_2O(l)$,
and the reaction takes place by a two step mechanism.
(i) What is the meaning of reaction mechanism?
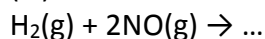(ii) Explain what a rate determining step is.
(iii) Giving your reasoning, write two equations that could describe the two mechanistic steps for the above reaction. It is important to identify the rate determining step.

**Answers:**
(i) A reaction mechanism is the step by step sequence of elementary reactions through which the overall chemical reaction occurs.
(ii) A rate determining step is the slowest step of complex reaction, and this step determines the overall reaction rate.
(iii) Based on the rate equation we can conclude that rate determining step is
$H_2(g) + 2NO(g) \rightarrow$ …
We also know that sum of the two mechanistic steps gives the overall equation.
For the step one product to be canceled when summarizing the two steps it should be a reactant of the second step. In consideration of all these we can write two equations that could describe the two mechanistic steps for the overall reaction:
1 step:   $H_2(g) + 2NO(g) \rightarrow 2HNO(g)$   $\leftarrow$  rate determining step
2 step:   $2HNO(g) + H_2(g) \rightarrow N_2(g) + 2H_2O(l)$
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Overall:  $2H_2(g) + 2NO(g) \rightarrow N_2(g) + 2H_2O(l)$