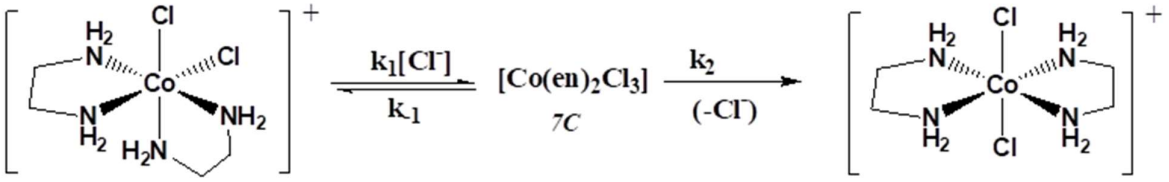
CHEM 412: II. Kinetics
Topic. Reaction Mechanisms and Steady State Approximation

Name: _____ **Roll No.** _____ **Submission date:** _____

Two Step Mechanisms and the Steady State Approximation

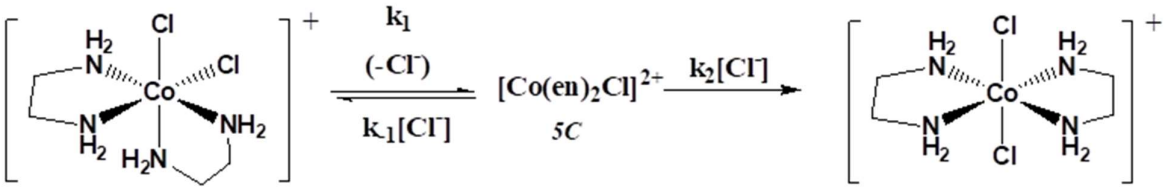
1. Consider the conversion of cis-$[Co(en)_2Cl_2]^+$ to trans-$[Co(en)_2Cl_2]^+$. One can envision two plausible mechanisms.

Mechanism: (associative)



cis *trans*

Mechanism: (dissociative)



cis *trans*

For each mechanism,

a. Derive the rate law
b. Show what happens to the rate law both when the first step is rate limiting and the second step is rate limiting
c. Give k_{obs} for each of the four cases.

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2. Now for a different sort of case. Let's imagine you wanted to convert your $[CoA_5Cl]^+$ to $[CoA_6^+]$. We can, again, imagine either an associative or dissociative mechanism:

Mechanism: (associative)

$$[CoA_5Cl]^+ \underset{k_{-1}}{\overset{k_1[A]}{\rightleftharpoons}} [CoA_6Cl]^+ \xrightarrow[(-Cl^-)]{k_2} [CoA_6]^{2+}$$

Mechanism: (dissociative)

$$[CoA_5Cl]^+ \underset{k_{-1}[Cl^-]}{\overset{k_1}{\underset{(-Cl^-)}{\rightleftharpoons}}} [CoA_5]^{2+} \xrightarrow{k_2[A]} [CoA_6]^{2+}$$

For each mechanism,

1. Derive the rate law
2. Show what happens to the rate law both when the first step is rate limiting and the second step is rate limiting
3. Give k_{obs} for each of the four cases.
4. Determine what happens to k_{obs} as [A] goes toward either 0 or ∞ (leaving $[Cl^-]$ constant). Draw a graph of k_{obs} vs. [A].
5. Finally, do the same thing you did in d. for $1/k_{obs}$, and plot $1/k_{obs}$ vs. 1/[A].