**Conference #3 – Chem 102** **Name**_____

$\ln[A]_t = \ln[A]_o - akt$ $1/[A]_t = 1/[A]_o + akt$ $\tau$ = [A]/rate of removal of A

1. $N_2O_5$ decays in a first order process as follows:

   $2\ N_2O_5 \rightarrow 2\ NO_2 + O_2$ $k = 5.0 \times 10^{-3}\ s^{-1}$

How long will it take for the concentration of $N_2O_5$ to drop from 0.050 M to 0.010 M?

2. NO reacts by itself in a second order process:

   $2\ NO \rightarrow N_2 + O_2$, where rate = $k[NO]^2$ and $k = 4.3 \times 10^{-41}\ M^{-1}s^{-1}$

a. What would be the half-life of NO given an initial concentration of $4.1 \times 10^{-9}$ M?

b. NO reacts more rapidly with $O_2$ as follows:

   $2\ NO + O_2 \rightarrow 2\ NO_2$ rate = $k[NO]^2[O_2]$ $k = 1.1 \times 10^{6}\ M^{-2}s^{-1}$

   Given $[O_2]$ at sea level is 0.0086 M, what is the lifetime of NO in the atmosphere?

4. Consider the following reaction mechanism

$HO + O_3 \rightarrow HO_2 + O_2$

$\underline{HO_2 + O \rightarrow HO + O_2}$

a. Write the balanced reaction for this process, identifying reactants, products, intermediates and catalysts.

b. What are the rate laws for each of these two elementary steps?

4. For the reaction: $Cl_2 + HCCl_3 \rightarrow HCl + CCl_4$
we get the unusual experimental result: rate = $k[HCCl_3][Cl_2]^{1/2}$

Show that this mechanism is consistent with the exp. rate law:

| | |
|---|---|
| $Cl_2 \Leftrightarrow 2\ Cl$ | *fast* |
| $Cl + HCCl_3 \rightarrow HCl + CCl_3$ | *slow* |
| $Cl + CCl_3 \rightarrow CCl_4$ | *fast* |

5. Use the steady state assumption to derive a rate law for the following mechanism:

$O_3 \Leftrightarrow O_2 + O$

$O + O_3 \rightarrow 2\ O_2$

a. Assume that $k_2 >> k_{-1}$, what is the rate law if the first step is rate-determining?

b. Assume that $k_{-1} >> k_2$, what is the rate law if the 2$^{nd}$ step is rate determining?