ASSIGNMENT 9

CHEMISTRY 300

Due: 4:30 pm Friday 28 November 2008

1. Consider three reactions, one first order in one reactant, one second order in two reactants, and one third order in three reactants. Integrate the rate law for each and find an expression for the half-life of each.

2. Consider the following reaction sequence:

$$\mathrm{A} \rightarrow \mathrm{B} \rightarrow \mathrm{C}$$

where the rate coefficients for each step are k_1 and k_2. Derive expressions for the time dependence of the concentrations of [A], [B], and [C]. (Hint: Consider separately the cases of $k_1 \neq k_2$ and $k_1 = k_2$.)

Using a spreadsheet, plot the three concentrations against time for the following cases:

(a) $k_1 = 6k_2$

(b) $k_1 = k_2$

(c) $6k_1 = k_2$

Extend the time axis to when [A] = .05 $[\mathrm{A}]_0$ and [C] = 0.95 $[\mathrm{A}]_0$.

3. The mechanism for the reaction:

$$\mathrm{H_2} + \mathrm{Br_2} \longrightarrow 2\mathrm{HBr}$$

is understood to be:

Initiation

$$\mathrm{Br_2} \longrightarrow 2\mathrm{Br} \qquad k_a$$

Propagation

$$\mathrm{Br} + \mathrm{H_2} \longrightarrow \mathrm{HBr} + \mathrm{H} \qquad k_b$$

$$\mathrm{H} + \mathrm{Br_2} \longrightarrow \mathrm{HBr} + \mathrm{Br} \qquad k_c$$

Inhibition

$$\mathrm{H} + \mathrm{HBr} \longrightarrow \mathrm{Br} + \mathrm{H_2} \qquad k_d$$

Termination

$$2\mathrm{Br} \longrightarrow \mathrm{Br_2} \qquad k_e$$

What is the rate expression predicted by this?

4. What would the rate law in 3 be if the inhibition step were:

$$\mathrm{Br} + \mathrm{HBr} \longrightarrow \mathrm{H} + \mathrm{Br_2} \qquad k'_d$$

instead?