CHM5250 – Kinetics and Reaction Dynamics Fall 2007
Graded Homework #1 **Due Wednesday, 8/29/07, 5pm**

Please write solutions neatly on a separate sheet of paper. Show all of your work and report answers with the correct significant figures and units.

1. Steinfeld 1.3b – the answer is given in the text; you just need to show correctly how to arrive at this solution.

2. Steinfeld 1.8

3. Steinfeld 1.10b – assume concentrations in molecules cm^{-3}.

4. (Espenson 1.1 – you do not have this book)
The major reaction between the ions of uranium(IV) and plutonium(VI) in aqueous solution is 2 Pu(VI) + U(IV) → 2 Pu(V) + U(VI). The rate of the reaction is

$$-\frac{d[\mathrm{Pu(VI)}]}{dt} = k_a[\mathrm{Pu(VI)}][\mathrm{U(IV)}]$$

at constant [H$^+$]. Under the conditions used, k_a = 2.2 L mol^{-1} s^{-1}.

a. What would the value of k_b be if one chose to reformulate the rate law as

$$-\frac{d[\mathrm{U(IV)}]}{dt} = k_b[\mathrm{Pu(VI)}][\mathrm{U(IV)}]$$

b. Suppose the rate-determining step is Pu(VI) + U(IV) $\xrightarrow{k_1}$ Pu(V) + U(V). What is the second and final step in the mechanism?

c. What is the numerical value of k_1?

d. Devise another two-step sequence that would also be consistent with the kinetic data.