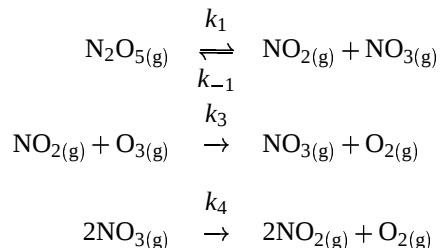


# Chemistry 2710 Spring 2001 Assignment 3

**Due:** Friday, March 2, 9:00 a.m.

1. The  $\text{N}_2\text{O}_5$ -catalyzed decomposition of ozone proceeds by the following mechanism:

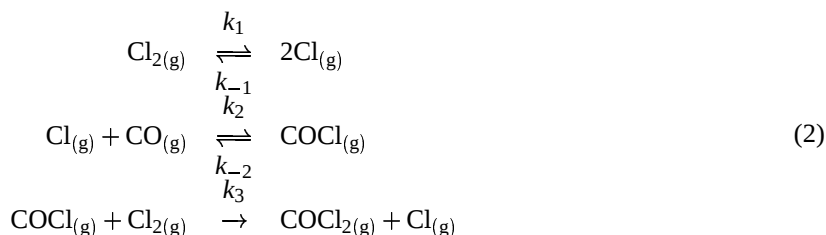
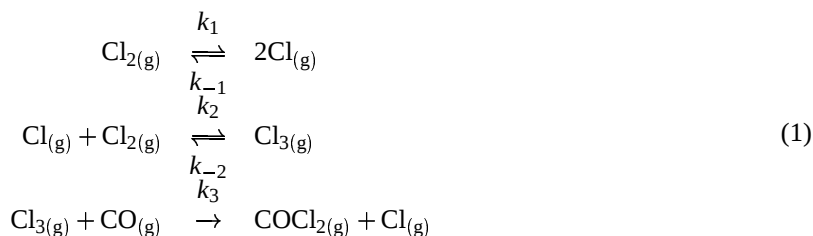


- (a) Write down the overall reaction. [3 marks]

Hint: The nitrogen oxides are catalytic species which do not appear in the overall process. You can ignore the first reaction which simply serves to create the true catalyst in this reaction, namely nitrogen dioxide.

- (b) The first reaction is known to equilibrate rapidly relative to the rate at which the other reactions proceed. Using this information, and assuming that the nitrogen trioxide concentration reaches a steady state, derive a rate law for this reaction involving only the ozone and dinitrogen pentoxide concentrations. [10 marks]
- (c) Is the rate law simple? If so, what are the orders of reaction with respect to  $\text{N}_2\text{O}_5$  and  $\text{O}_3$ ? [3 marks]
- (d) Do you get the same rate law if you simply use the SSA for both nitrogen dioxide and nitrogen trioxide? [5 marks]

2. Two mechanisms have been proposed for the reaction  $\text{CO}_{(\text{g})} + \text{Cl}_{2(\text{g})} \rightarrow \text{COCl}_{2(\text{g})}$ :



- (a) Identify the radical intermediates appearing in these mechanisms. [3 marks]
- (b) Identify the initiation, chain propagation and termination steps in both mechanisms. Are there any elementary reaction in either mechanism which don't fall into one of these categories? [10 marks]
- (c) Derive rate laws for both mechanism involving only concentrations of stable molecules. Could these mechanisms be distinguished experimentally? Explain. [20 marks]