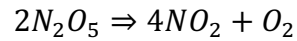


ChE-403 Problem Set 1.4

Week 4

Problem 1

Consider the decomposition of N_2O_5 :

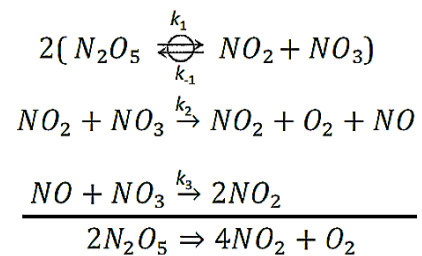


Experimentally, we observe that the rate of oxygen formation is consistent with the following expression:

$$\frac{d[O_2]}{dt} = k[N_2O_5]$$

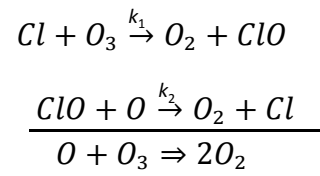
With k being a constant.

Is this compatible with the following suggested mechanism?



Problem 2

Consider the decomposition of ozone catalyzed by Cl :



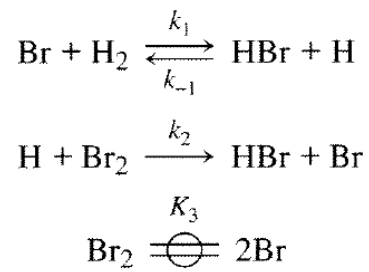
Can you use the steady state approximation on reactive intermediate ClO to show that the rate of ozone disappearance can be written as:

$$\frac{d[O_3]}{dt} = -\frac{k_1 k_2 [O][O_3][Cl]_0}{k_2 [O] + k_1 [O_3]}$$

Where $[Cl]_0$ is the Cl loaded/present in the system at $t=0$.

Problem 3

The formation of HBr from H₂ and Br₂ occurs through the following steps:



Can you derive a rate expression that looks like the following?

$$\frac{d[\text{H}_2]}{dt} = -\frac{cst1 [\text{Br}_2]^{1/2} [\text{H}_2]}{1 + cst2 \left(\frac{[\text{HBr}]}{[\text{Br}_2]} \right)}$$

What are the expressions of cst1 and cst2?