

CE213A- ODD SEMESTER 2018

Home Assignment 2: Chemical Kinetics

Q. 1. Determine, the lifetime of each of the reactants in the second-order reaction of nitric oxide and ozone: $\text{NO} + \text{O}_3 \rightarrow \text{NO}_2 + \text{O}_2$ $k(298\text{ K}) = 1.9 \times 10^{-14} \text{ cm}^3 \text{ molecule}^{-1} \text{ s}^{-1}$.

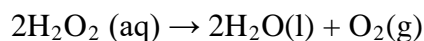
Q. 2. The decomposition of nitrous oxide at 565°C : $2\text{N}_2\text{O} \rightarrow 2\text{N}_2 + \text{O}_2$ is second order in N_2O with a rate constant of $1.10 \times 10^{-3} \text{ M}^{-1} \text{ s}^{-1}$. If the reaction is initiated with $[\text{N}_2\text{O}]$ equal to 0.108 M, what will its concentration be after 1250 s have elapsed?

Q. 3. What are the lifetimes of CHF_2Cl (HCFC-22) and CH_2ClCF_3 (HCFC-133a) by reaction with OH in the troposphere? Assume an average OH concentration of $[\text{OH}] = 106 \text{ molecules cm}^{-3}$ and an average tropospheric temperature of $T = 250 \text{ K}$. Reaction rate constants are (Sander et al. 2003):

$$k_{\text{OH}+\text{CHF}_2\text{Cl}} = 1.05 \times 10^{-12} \exp(-1600/T) \text{ cm}^3 \text{ molecule}^{-1} \text{ s}^{-1}$$

$$k_{\text{OH}+\text{CH}_2\text{ClCF}_3} = 5.6 \times 10^{-13} \exp(-1100/T) \text{ cm}^3 \text{ molecule}^{-1} \text{ s}^{-1}$$

Q. 4. For the decomposition of hydrogen peroxide in dilute sodium hydroxide at 20°C :



The average rate of disappearance of H_2O_2 over the time period from $t = 0$ to $t = 516 \text{ min}$ is found to be $8.08 \times 10^{-5} \text{ M/min}$. What is the rate of appearance of O_2 over the same time period?

Q. 5. What is ocean acidification? Explain its causes and significance in the atmosphere?

(Hint: Henry law)