

A molecule **A**, present at a concentration of 1 M, decomposes irreversibly into either molecule **B** or molecule **C**. The rate law for decomposition into molecule **B** is $\frac{dB}{dt} = k_1$ and that for molecule **C** is $\frac{dC}{dt} = k_2[A]^2$. For this problem, express your answers in terms of t , k_1 , and k_2 .

1. Write the rate law for the rate of decomposition of **A**.
2. Find the time dependence of the concentration of **A**.
3. How long will it take for all of **A** to be consumed?
4. After time t , what is the concentration of **B** and **C**? What is the ratio of the concentrations of **B** and **C** after the time found in part (c) elapses?

You may find the following integral useful:

$$\int \frac{dx}{a^2 + x^2} = \frac{1}{a} \arctan \frac{x}{a} + C$$