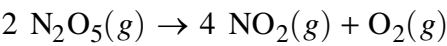


. The following equation represents the decomposition of N_2O_5 , for which the rate law is $\text{rate} = k[\text{N}_2\text{O}_5]$.



A sample of pure $\text{N}_2\text{O}_5(g)$ is placed in an evacuated container and allowed to decompose at a constant temperature of 300 K. The concentration of $\text{N}_2\text{O}_5(g)$ in the container is measured over a period of time, and the measurements are recorded in the following table.

Time (hr)	$[\text{N}_2\text{O}_5](M)$
0	0.160
1.67	0.0800
3.33	0.0400
5.00	0.0200

(a) Determine the value of the rate constant, k , for the reaction. Include units in your answer.

(b) The following mechanism is proposed for the decomposition of $\text{N}_2\text{O}_5(g)$.

- Step 1: $\text{N}_2\text{O}_5(g) \rightarrow \text{NO}_2(g) + \text{NO}_3(g)$
- Step 2: $\text{NO}_2(g) + \text{NO}_3(g) \rightarrow \text{NO}_2(g) + \text{NO}(g) + \text{O}_2(g)$
- Step 3: $\text{N}_2\text{O}_5(g) + \text{NO}(g) \rightarrow 3 \text{ NO}_2(g)$

Identify which step of the proposed mechanism (1, 2, or 3) is the rate-determining step. Justify your answer in terms of the rate law given.

GO ON TO THE NEXT PAGE.

Continue your response to **QUESTION 5** on this page.

(c) If this experiment was repeated at the same temperature but with twice the initial concentration of N_2O_5 , would the value of k increase, decrease, or remain the same? Explain your reasoning.

GO ON TO THE NEXT PAGE.