

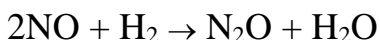
Chapter Four

1. For the hypothetical reaction $3A + B \rightarrow 5C + 2D + F$, write the reaction rate expression in terms of the disappearance of the reactants and the appearance of products?
2. For the following hypothetical reaction, $\Delta P(A_5C_{12})/\Delta t$ was found to be $-4.1 \times 10^{-2} \text{ atm/s}$.



Determine $\Delta P(C_2)/\Delta t$ for this reaction at the same time.

3. The data below were determined for the reaction



Exp. #	[NO]	[H ₂]	Initial rate
1	0.084	0.074	3.52 M/min
2	0.042	0.074	3.52 M/min
3	0.042	0.23	14.08 M/min

What is the rate law and rate constant for this reaction?

4. For the chemical reaction $A \rightarrow B + C$, a plot of $\ln[A]_t$ versus time is found to give a straight line with a negative slope. What is the order of reaction with respect to A?
5. Consider the reaction
 $A+B \rightarrow C$
The rate of the reaction is $1.6 \times 10^{-4} \text{ M/s}$ when the concentration of A is 0.5 M and the concentration of B is 0.4M. calculate the rate constant if the reaction is (a) first order in A and first order in B (b) first order in A and zero order in B?
6. A certain second-order reaction $A \rightarrow B$ is 63% complete in 42 min at 25°C. What is the half-life of the reaction?

7. A certain reaction $A \rightarrow \text{products}$ is zero order in A. If this reaction is 10% complete after 53 s, how long would it take the reaction to be 80% complete?
8. The isomerization of methyl isocyanide, $\text{CH}_3\text{NC} \rightarrow \text{CH}_3\text{CN}$, follows first-order kinetics. The half-lives were found to be 161 min at 199°C and 12.5 min at 230°C. Calculate the activation energy for this reaction.
9. Given that E_a for a certain biological reaction is 48 kJ/mol and that the rate constant is $2.5 \times 10^{-2} \text{ s}^{-1}$ at 15°C, what is the rate constant at 37°C?
10. The activation energy for the reaction $\text{CH}_3\text{CO} \rightarrow \text{CH}_3 + \text{CO}$ is 71 kJ/mol. How many times greater is the rate constant for this reaction at 200°C than at 130°C?
11. The rate law for the reaction $2\text{NO}_2 + \text{O}_3 \rightarrow \text{N}_2\text{O}_5 + \text{O}_2$ is rate = $k[\text{NO}_2][\text{O}_3]$. Which one of the following mechanisms is consistent with this rate law? Explain your answer?
- | | | |
|----|---|-------------|
| a) | $\text{NO}_2 + \text{NO}_2 \rightarrow \text{N}_2\text{O}_4$ | <i>fast</i> |
| | $\text{N}_2\text{O}_4 + \text{O}_3 \rightarrow \text{N}_2\text{O}_5 + \text{O}_2$ | <i>slow</i> |
| b) | $\text{NO}_2 + \text{O}_3 \rightarrow \text{NO}_5$ | <i>fast</i> |
| | $\text{NO}_5 + \text{NO}_5 \rightarrow \text{N}_2\text{O}_5 + (5/2)\text{O}_2$ | <i>slow</i> |
| c) | $\text{NO}_2 + \text{O}_3 \rightarrow \text{NO}_3 + \text{O}_2$ | <i>slow</i> |
| | $\text{NO}_3 + \text{NO}_2 \rightarrow \text{N}_2\text{O}_5$ | <i>fast</i> |
| d) | $\text{NO}_2 + \text{NO}_2 \rightarrow \text{N}_2\text{O}_2 + \text{O}_2$ | <i>slow</i> |
| | $\text{N}_2\text{O}_2 + \text{O}_3 \rightarrow \text{N}_2\text{O}_5$ | <i>fast</i> |
12. The reaction $2\text{A} + 3\text{B} \rightarrow \text{C}$ is second order with respect to A and zero order with respect to B. When the initial concentrations are $[\text{A}] = 1.6 \times 10^{-3} \text{ M}$ and $[\text{B}] = 2.4 \times 10^{-2} \text{ M}$, the rate is $4.1 \times 10^{-4} \text{ M/s}$. Calculate the rate constant of the reaction?