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 -4.1×10^{-2} atm/s.

   $A_5C_{12}(g) \rightarrow A_5C_6(g) + 3C_2(g)$

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

3. The data below were determined for the reaction

   $2NO + H_2 \rightarrow N_2O + H_2O$

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 1.6×10^{-4}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 → *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, $CH_3NC \rightarrow CH_3CN$, 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 $2.5 \times 10^{-2}\ s^{-1}$ at 15°C, what is the rate constant at 37°C?

10. The activation energy for the reaction $CH_3CO \rightarrow CH_3 + CO$ 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 $2NO_2 + O_3 \rightarrow N_2O_5 + O_2$ is rate = $k[NO_2][O_3]$. Which one of the following mechanisms is consistent with this rate law? Explain your answer?

a) $NO_2 + NO_2 \rightarrow N_2O_4$ *fast*
$N_2O_4 + O_3 \rightarrow N_2O_5 + O_2$ *slow*

b) $NO_2 + O_3 \rightarrow NO_5$ *fast*
$NO_5 + NO_5 \rightarrow N_2O_5 + (5/2)O_2$ *slow*

c) $NO_2 + O_3 \rightarrow NO_3 + O_2$ *slow*
$NO_3 + NO_2 \rightarrow N_2O_5$ *fast*

d) $NO_2 + NO_2 \rightarrow N_2O_2 + O_2$ *slow*
$N_2O_2 + O_3 \rightarrow N_2O_5$ *fast*

12. The reaction $2A+3B \rightarrow C$ is second order with respect to A and zero order with respect to B. When the initial concentration are $[A]=1.6\times10^{-3}M$ and $[B]=2.4\times10^{-2}M$, the rate is $4.1\times10^{-4}M/s$. Calculate the rate constant of the reaction?