CHEM 14B
WINTER 2024

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Chemical Kinetics

7th Edition: Focus 7 (Omit 7C.5)
Problems 7A: 1, 3, 7, 9, 11, 13, 15, 17; 7B: 1, 3, 5, 7, 9, 13, 15, 17; 7C: 1, 3, 5, 7, 9, 11;
7D: 1, 5, 7; 7E: 1, 3, 5, 7; and 7.1, 7.3, 7.9, 7.11, 7.17, 7.21, 7.23, 7.25, 7.27, 7.31

After going through the readings & problems and attending the lectures & discussion groups, you should be able to:

- Understand what is mean when kinetics rather than thermodynamics is controlling a reaction.
- Show how the rate of change of one species in a reaction is related to that of another species.
- Show how the instantaneous rate is obtained by drawing a tangent to the graph of concentration versus time.
- Know how to apply the method of initial rates to determine the order of a reaction, its rate law, and its rate constant from experimental data.
- Know how to derive the differential and integrated rate laws for zero, 1st and 2nd order reactions and know how to derive their respective half-life equations.

1st Order:	$-\frac{d[A]}{dt} = k\,[A]$	$\ln [A] = -k\,t + \ln [A]_o$	$t_{1/2} = \frac{0.693}{k}$
2nd Order:	$-\frac{d[A]}{dt} = k\,[A]^2$	$\frac{1}{[A]} = k\,t + \frac{1}{[A]_o}$	$t_{1/2} = \frac{1}{k\,[A]_o}$
Zero Order:	$-\frac{d[A]}{dt} = k$	$[A] = -k\,t + [A]_0$	$t_{1/2} = \frac{[A]_o}{2\,k}$

- Be able to use the appropriate integrated rate law to determine the order of a reaction.
- Calculate a concentration or rate constant by using an integrated rate law.
- Given the integrated rate law for a zero-order, first-order and second-order reaction, obtain the half-life equation and calculate the half-life or rate constant (depending on the available data).
- Know how to determine the order of a reaction, its rate law, and its rate constant for reactions with more than one reactant.
- Write rate laws for elementary reactions.
- Propose a reaction mechanism from a rate law.
- Determine a rate law from a mechanism.
- Be able to analyze pre-equilibrium reaction mechanisms.

- Know how the equilibrium constant is related to the forward and reverse rate constants of the elementary reactions contributing to an overall reaction.
- Explain how the collision model and activated complex model account for the temperature dependence of reactions.
- Interpret or draw a reaction profile.
- Use the Arrhenius equation ($k = A \exp(\frac{-E_A}{RT})$) and rate constants measured at different temperatures to determine activation energy.
- Use the Arrhenius equation and the activation energy to find the rate constant at a given temperature.
- Explain how a catalyst lowers the activation energy of the transition state.
- Explain how a catalyst increases the rate of a reaction.
- Identify a catalyst in a reaction and give an example of a catalytic reaction.
- Understand the difference between activation energy and free energy of activation.

The assigned problems from Chemical Principles bring together many physical chemistry concepts by applying them to industrial, environmental, inorganic, organic, biochemical, and biological examples. I hope you found them interesting.

Many topics covered in Chem 14A and 14B form the basis to understanding the wonderful world of chemistry that surrounds us.

I wish you success in all your current and future studies, activities, and career.

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Dr. Laurence Lavelle