Chemistry 326 **"Chemical Kinetics"** **Spring 2021**
(3 March 2021)

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Office Hours: *via* the Webex link on the Canvas site, 4:10 p.m. Thursdays. If this time is inconvenient, please contact me by email to schedule another meeting.
Grader: Dorian Twedt Gutierrez: dtwedt@iastate.edu

Meeting Times and Place: Contrary to what was published earlier on the online Schedule of Classes, this course is offered online and asynchronously. The best way to learn a subject such as this is to work the problems. Please take advantage of my availability during office hours to discuss problems you may encounter.

Student Learning Outcomes. Students completing Chemistry 326 are expected to understand at an intermediate level: rate laws, temperature dependence of rate constants, reaction mechanisms, kinetic isotope effects, and (time permitting) Michaelis-Menten kinetics, transition-state theory, and Marcus theory.

Prerequisites. Chemistry 167 or 177 or 178 or 201; Math 166. Chemistry 324 and 325 are recommended.

Course Materials. Class notes are posted on Canvas. The main text is *Chemical Kinetics and Reaction Dynamics* by Paul L. Houston. Other useful, but not required, references are:

Physical Chemistry, a Molecular Approach, McQuarrie and Simon, which many of you may already have if you have taken Chemistry 324 or 325. (This is the "big red book," not the partial texts that treat only quantum mechanics or statistical thermodynamics.) Chapters 27-29 cover much of the material that we treat in this course.

Enzyme Structure and Mechanism, Fersht, Chapters 3 and 4. Although this book is intended to address enzyme kinetics, it provides a thorough, clear, and complementary treatment of much of the material in Chapter 2 of Houston.

Excerpts are posted on Canvas.

Mathematical software such as MathCAD, MATLAB, *etc.* will be necessary for understanding many of the discussions in the text as well as for working problems. Numerical computation, fitting of data, and plotting of results is required in order to obtain credit for problems. Some examples using MathCAD code are provided on Canvas.

Problem Sets. The course grade will be based *entirely* upon four problem sets, which will be due at the following dates and times:

set 1 (20%), Friday, 26 March, 11:59 p.m. on Canvas;
set 2 (20%), Friday, 2 April, 11:59 p.m. on Canvas;
set 3 (25%), Friday, 16 April, 11:59 p.m. on Canvas;
set 4 (35%), no later than noon on Thursday, 6 May, on Canvas. Understanding the solution to this problem set is one of the most valuable outcomes of the course, as it synthesizes many of the fundamental principles covered. This set is difficult. Do not attempt it the night before it is due.

Problem sets are to be submitted as PDF files *via* Canvas. Problem sets handwritten on paper should be neatly scanned, such as by using a smartphone scanning app. (Scanners are also available at Parks Library.) Blurry or otherwise difficult to read photos or scans will not be graded. Feedback on problem sets will be provided *via* Canvas. Late problem sets will not be accepted.

The weight of each set towards the final grade is in parentheses.

1. Problem sets are to be turned in before their deadlines. Students may work together, but they must express their responses in their own terms. Identical (*i.e.*, copied) papers will be graded as zero. **Problem sets must be legible and neatly presented. It is reasonable to rewrite one's responses once they have been formulated.**

All work must be shown on a problem set, and sufficient explanation must be provided to indicate that you know how to solve a problem. Many problems require the use of a computer program to generate the answer. Explanation of the solution with equations and words (complete sentences) is required to receive credit for your answer.

a. Simply presenting the "code" used to generate the solution will result in no credit. Detailed explanation in complete sentences is required for all work submitted.

b. Plots of fitted data are always required.

2. **Regrading Policy.** Any appeal regarding a grade must be made to the grader electronically no later than two "school days" after the problem set has been graded. Problem sets submitted for appeal may be subject to complete reevaluation.

3. **+/- grading will be used. There is no curve for the course**. Grades will *tentatively* be assigned as follows:

100-90: A
89-75: B
74-50: C
49-40: D
<40: F

Topic	Reading (class notes and…)
rates of reaction, rate constants, and rate laws; order of reaction; half life	M&S, Chap. 28*; Houston, pp. 34-37
determining reaction order by measuring the change in conc. *vs*. time	Houston, pp. 37-47
Arrhenius behavior; time dependence of equil., consec., and parallel rxns.	Houston, pp. 48-51
steady-state approximation; Lindemann mechanism	Houston, pp. 51-56
enzyme function; proper description of the equilibrium constant in terms of μ	Houston, pp. 56-63
Michealis-Menten kinetics *vs*. Briggs-Haldane kinetics	Houston, pp. 64-67
chain reactions; discussion of Houston 2.32	Houston, pp. 72-81, prob. 2.32
idem	*idem*

* The scanned chapter is provided on Canvas.

Special Needs and Accommodations.

Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. All students requesting accommodations are required to meet with staff in Student Disability Resources (SDR) to establish eligibility. A Student Academic Accommodation Request (SAAR) form will be provided to eligible students. The provision of reasonable accommodations in this course will be arranged after timely delivery of the SAAR form to the instructor. Students are encouraged to deliver completed SAAR forms as early in the semester as possible. SDR, a unit in the Dean of Students Office, is located in room 1076, Student Services Building or online at www.dso.iastate.edu/dr/. Contact SDR by e-mail at disabilityresources@iastate.edu or by phone at 515-294-7220 for additional information. In particular, current policy for accommodations is formed by the Office of Civil Rights/Department of Education, http://www2.ed.gov/about/offices/list/ocr/transition.html. The salient points are:

- Students requesting reasonable accommodations for documented disabilities must meet with Student Disability Resources ('SDR') staff to determine eligibility and complete SAAR forms, if appropriate.
- Students are encouraged to present SAAR forms to Instructors during office hours as early in the term as possible so they can benefit from the indicated accommodations and to allow Instructors the opportunity to plan and to assist more effectively.
- Students may present their SAAR forms at any time during the term.
- Instructors are to provide accommodations from the date of the their signature on the SAAR form going forward in time

- Disability Accommodations are not "retroactive." This means that Instructors are not required to provide disability accommodations as indicated on a SAAR form for previous course activities (*i.e.*, completed exams, passed "due dates," *etc*.)

Academic Misconduct. Academic Misconduct in any form is in violation of ISU *Student Disciplinary Regulations* and will not be tolerated. This includes, *but is not limited to*, copying answers on tests or assignments, plagiarism, and having someone else do your academic work. Depending on the act, a student could receive an F grade on the test or assignment, F grade for the course, or could be suspended or expelled from the University. See the Conduct Code at http://www.dso.iastate.edu/ja for more details and a full explanation of the Academic Misconduct policies.

Right to Privacy. The Federal Right-to-Privacy Act prohibits the public disclosure of exam scores.