

## Chemical Kinetics for High School Teachers

CHEM 899-02, Summer 2017

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2 Credit hours, Online Format

June 5 – July 28

*The best method to contact me is via email. I will attempt to respond within 24 hours. If an email is sent on a weekend, then I will respond by the following Monday. Limited to No contact from July 11 to July 16 and on July 24<sup>th</sup>.*

*A question and Answer Discussion Board will be set up on Blackboard, so that I can answer questions and field concerns. Often, questions that you may have may be similar to a question posed by another student so check the discussion for information.*

**Required textbook:** Thermodynamics, Statistical Thermodynamics, & Kinetics, 3<sup>rd</sup> edition by Thomas Engel and Philip Reid; ISBN-10:0-321-76618-0; ISBN-13:978-0-321-76618-2

Any supplemental handouts and internet references will be provided by the instructor

**Technical Requirements and Competencies.** Course delivery will be made entirely through Blackboard. A broadband internet connection (DSL, cable, etc.) is recommended but the instructor will make every effort to keep the size of course documents down to accommodate those with dial-up internet connections. Course documents may be in Adobe PDF or Microsoft Office (Word, Excel, and PowerPoint) formats. It is expected that you be able to download documents and open them in their appropriate programs. Exams will be taken on Blackboard. Familiarity with standard online form functions – radio buttons, check boxes, fill-in blanks, etc. – is required.

**Course Description.** This course emphasizes the following topic areas: reaction rates, rate laws, integrated rate law, reaction mechanisms, parallel reaction, temperature dependent rate constants, reversible reactions, potential energy surfaces, activated complex theory, transition state theory, catalysis, radical-chain reactions, and photochemistry. This course is offered for 2 **credits** without laboratory.

**Course Learning Structure.** Course content is divided between four modules:

**Module 1** – Kinetic Theory of Gases and Transport Phenomena

**Module 2** – Elementary Chemical Kinetics

**Module 3** – Elementary Chemical Kinetics

**Module 4** – Complex Reaction Mechanisms

Each module, will have **Readings** – from the textbook, instructor-generated supplemental handouts, and internet resources and **Homework Problems** – from end-of-chapter textbook problems and/or instructor-generated handouts.

Your grade will be based on the number of accumulated points as a percentage of the total possible number of points according to the distribution given below:

### **GRADING DISTRIBUTION\***

Exams (4)	50% (4 × 100pts)
Graded Homework	25% (8 × 25pts)
Term Project	25% (200 pts)

**Exams.** Four timed examinations of 90 minute lengths will be given. These may consist of a variety of question formats (multiple choice, multiple answer, matching, short answer, problem solving). Each exam will cover one module. There will be no cumulative “final” exam. If you have computer / blackboard issues while taking an exam, contact me immediately.

**Homework.** There will be two homework assignments per module. Assigned questions may come from the textbook end-of-chapter problems and/or be generated by the instructor.

**Term Project.** This focuses on the incorporation of higher-level science or math material into one of the courses you teach. The project features two discussion board assignments that explore the idea of adjusting language (jargon) and making higher-level material more accessible to students. A complete description of the project is given later.

**Grading Scale.**

	A = 93 – 100%	A- = 90 – 92%
B+ = 88 – 89%	B = 83 – 87%	B- = 80 – 82%
C+ = 78 – 79%	C = 73 – 77%	C- = 70 – 72%
D+ = 68 – 69%	D = 63 – 67%	D- = 60 – 62%
	F ≤ 59%	

**DEADLINES.** A table of deadlines for all assignments and exams is given. *To keep the class flowing smoothly, these deadlines will be strictly adhered to.* The following penalties will be applied to late work:

Up to 24 hours late	25% of possible points (or zero score for discussion board response)
Between 24-48 hours late	50% of possible points (or zero score for discussion board response)
Over 48 hours late	Zero score

(**NOTE:** These late times apply to business days only. Business days are defined as Monday-Friday except holidays).

	Textbook Sections	Broad Objectives
Module 1	Chapter 16	Understand Kinetic Theory of Gas motion and Pressure Discuss Velocity distribution and Maxwell Distribution of speed Understand Effusion
Module 2	Chapter 18.1-18.6	Apply Reaction rates Apply Reaction rate laws Understand Reaction Mechanisms Apply Integrated Rate Laws
Module 3	Chapter 18.7-18.15	Understand Parallel vs Sequential Reactions Understand Temperature dependence of rate constants Derive reactions rates for Equilibrium reactions Discuss Potential Energy Surfaces
Module 4	Chapter 19	Discuss more complex mechanisms Understand the preequilibrium Approximation Understand the Lindemann Mechanism Apply Catalysts to Potential Energy Surfaces Understand Radical-chain Reactions / Polymerization Understand Photochemistry

## CHEM 899-02 -- Summer 2017 -- Deadline Summary

Date	Assignment
Wednesday, June 7	Home Work Assignment #1
Friday, June 9	Home Work Assignment #2
<b>Wed.-Fri, June 14-16</b>	<b>Exam #1</b>
Monday, June 19	Discussion Part 1(A)
Wednesday, June 21	Discussion Part 1(B) Home Work Assignment #3
Friday, June 23	Discussion Part 1(C) Home Work Assignment #4
<b>Tues.-Fri., June 27-June 30</b>	<b>Exam #2</b>
Monday, July 3	Discussion Part 2(A)
Friday, July 7	Discussion Part 2(B) Home Work Assignment #5
Monday, July 10	Discussion Part 2(C) Home Work Assignment #6
<b>Thurs.-Sat, July 13-15</b>	<b>Exam #3</b>
Wednesday, July 19	Home Work Assignment #7
Friday, July 21	Term Project, Phase 1 Home Work Assignment #8
<b>Wed-Fri, July 26-28</b>	<b>Exam #4</b>
July 28	Term Project, Phase 2

**Exam time windows begin at 8:00 a.m. CST on the first day and end at 11:00 p.m. CST on the last day.  
Other deadlines are at 5:00 p.m. CST unless otherwise noted.**

**If you have computer / blackboard issues while taking an exam, contact me immediately.**

## CHEM 899-02 Term Project – Summer 2017

### Incorporating Higher-level Chemistry into Grade 6-12 Courses

**Part 1 and 2 – Discussion Board Exercise (Final product ideas, 25 pts each).** First, choose your class to focus on. If you teach more than one subject, use the following priority: 1) Chemistry; 2) Physical or Earth Science (HS or MS); 3) Physics; 4) Math (HS or MS) 5) Biology (HS or MS); . Submit discussion board posts according to the following guidelines.

- Level A** – State the class subject and level. Describe two possible class topics on which to base the final product (1<sup>st</sup> topic = part 1 and 2<sup>nd</sup> topic = part 2). One of these topics must be something you already teach but you would like to cover in greater detail. The other topic must be something new and considered more advanced. Discuss why you believe these enhancements would be beneficial for students and describe the specific CHEM 899-02 material that would apply. (NOTE: If you teach outside of chemistry and physical science, the CHEM 899-02 material may serve as either applications to your topics or as inspirations (in their educational approach) for how you address your topics – in either case, the instructor will notify you if your CHEM 899-02 connection is not sufficient.) Rubric for **level A** discussion board posts:

Grade	Posted on Time	Quantity	Quality
Excellent (15 points)	Yes	Comments are significant in length and address presented concepts.	Comments indicates an understanding of the complexity of the issues or presented concepts.
Good (12 points)	Yes	Comments are brief, but address the specific concepts.	Comments indicates a fair understanding of presented concepts.
Fair (9 points)	Yes	Comments are brief but does address the concepts, minimally.	Comments indicates some understanding of the presented concepts.
Attempted (6 points)	Yes	Comments are brief and does not address presented concepts.	Comments indicates a weak grasp of presented concepts.
Poor (0 points)	No	Late posts not accepted.	Late posts not accepted.

- Level B** – You will be assigned to respond to two other students' Level 1 posts. For each proposed topic, offer at least one suggestion that the original poster could take to bring that topic (or greater detail) into his or her class. Also, point out at least one challenge that may need to be overcome in the process. Completed on time and on topic, 5 points.
- Level C** – Respond to the Level 2 posts about your Level 1 post. Completed on time and on topic, 5 points.

**Part 3 – Final Product, Phase 1 (50 pts).** This will be a paper assignment that is turned in using the assignment function in Blackboard. It will focus on the background for your proposed class enhancement.

- **If you chose to introduce a new, advanced topic:** Describe the role of this topic in the class curriculum and in any pertinent local/state/federal standards. Without worrying about scaling material down to your class level, thoroughly describe the content you would like to teach – there must be at least one lecture/guided discussion and at least one assessment (test, quiz, homework, presentation) or lab/field experience. Point out specific areas that make this topic difficult to teach to students at your class level, whether it's advanced concepts, difficult jargon, lack of demonstration equipment/supplies, etc. Outline – a few bullet points are fine – how you intend to make modifications in order to make the lesson plan more appropriate for your class level.
- **If you chose to enhance a topic you already teach:** Present your current method (including PowerPoint notes, assignments, tests/quizzes, demonstration notes, presentation rubrics, etc.) of teaching this topic -- there must be at least one lecture/guided discussion and at least one assessment (test, quiz, homework, presentation) or lab/field experience. Point out specific areas that make it difficult to teach this topic at a deeper level, whether it's advanced concepts, difficult jargon, lack of demonstration equipment/supplies, etc. Outline – a few bullet points are fine – how you intend to make modifications in order to make the lesson plan more appropriate for your class level.

**Part 4 – Final Product, Phase 2 (100 pts.).** This will be a paper assignment that is turned in using the assignment function in Blackboard. It will focus on the new or enhanced topic lesson that you have prepared utilizing CHEM 899-02 material (directly, as application, or as inspiration). Feedback will be given after phase 1.

Present your new method (including PowerPoint notes, assignments, tests/quizzes, demonstration notes, presentation rubrics, etc.) of teaching this topic -- there must be at least one lecture/guided discussion and at least one assessment (test, quiz, homework, presentation) or lab/field experience. Point out specific areas where you have utilized CHEM 899-02 material, made language simplifications, and made simplifying assumptions. For the latter two, include comment on their impact on the rigor of the lesson.