

Course Syllabus

Chem 122: Honors Introductory Chemistry

Fall 2009

Class Meetings

MWF: 9:10a – 10:00a

Tomsich 207

Instructor

Simon Garcia

Tomsich 108

garcias@kenyon.edu

427-5077

Textbook

S. Zumdahl, *Chemical Principles*, 5th edition

Office Hours

TBA, please check the course website (below).

Course Website

<https://moodle.kenyon.edu/course/view.php?id=3781>

Important Dates

Exam 1: September 18, Friday, 9:10a – 10:00a

Exam 2: October 16, Friday, 9:10a – 10:00a

Exam 3: November 13, Friday, 9:10a – 10:00a

Final: December 20, Sunday, 8:30a – 11:30a

Course Description and Goals

What is this course about? A molecular perspective of the world is crucial to understanding how things work and empowers us to solve problems facing all of humanity. In this course, we will learn the most significant principles of modern chemistry — principles that revolutionized our understanding of nature and transformed the world itself. At the same time, we will learn how to combine these principles with quantitative methods to investigate and solve problems relevant to environmental studies, energy technology, medicine, and nutrition. My ultimate hope is that molecular insights will prepare you to investigate several challenges facing all of humanity, including global climate change, sustainable technology, and health care.

Topics will encompass atomic theory, chemical reactivity, chemical thermodynamics, and molecular structure. We will approach each topic within the context of a central theme: Energy and Technology. In addition to learning chemical principles, you will also develop professional scientific skills: using chemical theory to evaluate observations (and *vice versa*), presenting quantitative arguments, and using evidence to support scientific conclusions.

What will you get from this course? There are two main goals for this course. The first goal is to use the principles, language, and quantitative concepts of modern chemistry to explain phenomena that you will encounter in advanced science courses. This means that you will be able to solve a set of common, “standard” problems that chemistry students encounter all over the world.

The second goal is one that exemplifies a rigorous, liberal-arts education. I expect you to use fundamental principles of chemistry to solve *novel problems that you have never seen before*. You will likely find this goal frustrating, but be patient and persist. Previous students tell me that they find the challenge to be ultimately rewarding and excellent preparation for advanced courses in biology, chemistry, and physics. In addition, you will need practice with this type of problem solving if you ever plan to take advanced examinations, such as the MCAT, GRE, or graduate school qualifying exams.

Requirements

Prerequisites. You need one year of introductory chemistry in secondary school. Enrollment is limited to 1st-year students, and to 2nd-year students with the instructor’s permission.

Co-requisites. To take Chem 122, you must take Chem 123 (Introductory Chemistry Laboratory) at the same time.

Mathematics Background. You should be comfortable with standard algebraic procedures (*e.g.*, solving for unknowns, simplifying expressions, canceling factors). You should know the algebraic properties of exponents, logarithms, and powers, and you should be able to enter these operations (including exponentiation and logarithms) on a calculator and personal computer.

Physics Background. High-school physics is not required, but you do need to be familiar with basic physical concepts (like force, energy, temperature, and waves) and unit conversions for energy. These topics are covered in an introductory physical science course in high school.

Quizzes

For each week of class, I will post readings, exercises, and quizzes at the Moodle website for Chem 122. I encourage you to work on the assigned readings and exercises with a study partner or group. There will also be two quizzes per week, due on Sunday and Thursday evenings, each at 10:00p. On quizzes you must work *alone*, so you will be prepared for these questions on exams.

What are the quizzes for? The quizzes will help you decide if you understand the week's reading. You should study the assigned reading first, and then take the quiz. Most quiz questions will be simple and straightforward, to make sure you have the basic concepts down. A few will be more difficult, and their purpose is to make sure you can apply these concepts to new situations. If you have trouble with a few quiz questions, then you should go back and review the relevant topics.

Problem Sets

Along with each reading, I will also assign problem sets drawn from the text or of my own design. I expect you to read these problem sets as soon as I post them, and to come to lecture prepared to discuss them. We will discuss a few — but not all — of the problems in class. Problem sets are due at the beginning of class on Friday.

You will work on problem sets within a team, and your team will turn in a single set of group solutions to the problem set. I expect you to work on all problems by yourself, meet with your team to agree on group solutions, write up the team's solutions, and then write down the solutions for yourself. This last part is important, because exams will have questions about the problem sets.

Your team's solutions must be prepared in an electronic format, using the MS Word template file provided, and printed out for submission. You may leave spaces for equations and drawings (and draw them by hand after printing), but all text must be typed and printed.

The Lead Tutor (LT) for this course will lead a 15-minute discussion of the problem set to help you get started. The LT will lead these discussions in the Math Science Skills Center (MSSC). If the discussion time fits into your schedule, you are strongly encouraged to attend with the members of your team.

Examinations

Each examination is cumulative: it may test on any topic since the *beginning* of the course (not since the previous exam). Mid-term exams are 50 minutes long and take place during class. The final exam is 3 hours long and takes place on the scheduled exam day for our class. Because of limited time, it is impossible to include every question encountered in class. For this reason, actual exam questions will be a *sample* of topics. Obviously, I cannot tell you which topics will be chosen, so please do not ask.

Grading

- 10% Quizzes
 - 25% Problem Sets
 - 15% Exam 1
 - 15% Exam 2
 - 15% Exam 3
 - 20% Exam 4 (Final)
-

Working in Teams

Working collaboratively in teams is an essential and inescapable part of working on real projects that affect the world. Professional surveys show that employers, medical schools, and graduate schools all prize students who can work in teams *effectively*. In a hiring pool of equally brilliant candidates for a job, the ability to thrive in a collaborative situation marks you as extraordinary. From my experience in the U.S. government's most prestigious research laboratories, I can assure you that a collaborative approach to a project makes the difference between soaring success and spectacular failure.

I will assign you to work in teams of 2–4 on your *problem sets only* (not on quizzes or exams). You must sign a contract certifying that everyone contributed to each problem set, and that you accept the same grade as everyone else in your team. The appropriate form is available at the course web page.

When you get a problem set, please attempt to solve each problem by yourself within the first week. On the hardest problems, you probably won't finish within a week, but at least you'll have some idea of what makes the problem hard. Then you can meet with your team, compare ideas, and finally agree on a set of final solutions that you will turn in as a group.

I will assign you initially to a team of 2–4. You will work with this team on the first problem set. Afterward, you may choose a new team to work on the remaining problem sets.

Academic Honesty

Please read the College's statement on Academic Honesty in the *Course of Study*, pages 26–29. Pay special attention to the definition of plagiarism and to the list of activities that violate the standards of academic honesty. I expect you to avoid plagiarism and cheating and to avoid even the mere appearance of possible plagiarism or cheating.

Excused Absences

Planned Absence. If you cannot attend a class or exam or finish an assignment because of an athletic, religious, or other event, you can make it up *before* the scheduled date, not afterward. I need at *least 2 weeks advanced notice* (let me know as early as possible, though).

You are allowed a **maximum of two** planned, excused absences. Check all of your commitments for this semester and find any possible conflicts. If you find conflicts and aren't sure what to do about them, *consult with me as soon as possible*.

Unplanned Absence. If you miss class, quiz, exam or assignment because of an *unexpected* event, such as illness, depression, bereavement, or the Imperius Curse, notify a Student Support specialist. In most cases, the appropriate people may include: the Dean of Academic Advising, the Dean of Students, and the staff of the Health and Counseling Center.

Tell me which person above you talked to, and I will verify your situation with this person. The people above maintain confidentiality: They will not discuss the reason for your absence with me. **Without verification, I will not accept late work and I will not schedule a make-up for the work.**

Influenza. If you experience flu-like symptoms, call the Health Center immediately. Depending on your symptoms, they may advise you to **self-isolate** (stay confined to your room) to minimize the chances of spreading the flu. In this case, please do not come to class. Ask the Health Center to send me a message confirming your situation. Send me a message to inform me, and ask a friend to photocopy their notes for you. You must call or email the Health Center each day to keep them updated.

Late Work

I do not accept any late work at all without an official, excused absence (see above).

Disability Services

Accommodations. If you have a learning disability or physical disability, or think that you might, please schedule an appointment with Disability Services *as soon as possible*. Only the Coordinator of Disability Services is authorized to review your documentation and to recommend an accommodation. I will work with you and with them to arrange an accommodation tailored to your situation.

If your accommodation grants extra time on an exam, you must inform me *two weeks before the exam*.

Coordinator of Disability Services. Erin Salva is the Coordinator of Disability Services. You can reach her by phone at 427-5453 or by email at salvae@kenyon.edu.

Changes to the Syllabus

The policies articulated in this Syllabus are subject to change in response to unusual situations. Students will be notified of any changes at least 48 hours before those changes go into effect.

Stay focused

I have all sorts of people come to my class: the bright and the not so bright, the motivated and the lazy, the experienced and the novice. Regardless, the people who get the most from the class are always the ones who remain focused on the topic at hand.

The first trick to maintaining focus is to get enough sleep. I suggest ten hours of sleep each night while you are studying new ideas. Before dismissing this idea, try it. You will wake up refreshed and ready to learn. *Caffeine is not a substitute for sleep.*

The second trick is to stop thinking about yourself. While learning something new, many students will think, “Damn, this is hard for me. I wonder if I am stupid.” Because stupidity is such an unthinkable terrible thing in our culture, the students will then spend hours constructing arguments that explain why they are intelligent yet are having difficulties. The moment you start down this path, *you have lost your focus.*

Before going any further, assure yourself that you are not stupid and that some things are just hard. Armed with this silly affirmation and well-rested mind, you are ready...

—Aaron Hillegass, *Cocoa Programming for Mac OS X*

Frequently Asked Questions

1. When I come to office hours, why do you answer my question with a question?

Both educational research and my own experience agree: Simply telling students the answer does not help them learn much. You learn most effectively by trying out different methods. If you are stumped by a problem, I will try to lead you through this process by asking you a series of questions that help *you* to come up with the answer yourself. Don't be discouraged: In the end, you will **learn to ask good questions** when confronted with any problem, and to find the answer in the process.

I realize that you have a busy schedule and limited time, and I will keep that in mind. When you come to office hours, don't hesitate to remind me that you must leave at a certain time.

2. What are exams like?

Tests will mostly have a type of question called *quantitative problem solving*. This type of question requires you to read a passage that describes a problem, and your goal is to solve the problem, usually by doing some calculations. The passage will contain some information that you need (but not necessarily all of it), and some information that you don't need. Your task is not only to come up with an answer to the question, but also to show the reader why your answer is correct. This type of question requires you to (a) use the right set of concepts for solving it, and (b) be very careful in setting up your calculation (i.e., avoid math errors, carry units properly, etc.).

At least 80% of each exam will be standard problems similar to the ones in the textbook and on the quizzes. The rest will be “novel” problems that haven't seen before.

3. How should I study for Chem 122?

Different study strategies work for different people. The most general advice I can give you is to practice solving problems. For each problem, don't just blindly search for equations that “look right” — try to think about what makes the problem different from — and similar to — other problems, and what *concepts* it's testing.

Another strategy is to make up your own problems. The process of making up a problem helps you think about how to test chemical concepts. In fact, if you come up with a great problem, I encourage you to submit it to me. You might find your own problem on the next exam, and I promise not to tell anyone you came up with it (unless you want the acknowledgment).

4. I feel like I'm studying so hard, but I don't feel like I understand everything. Am I stupid?

This is the wrong question. You are at a highly selective liberal arts college, taking a very difficult class. **You are not stupid.** The more time you spend thinking about this question, the more time you waste being miserable, instead of studying, working, and enjoying life.

If you feel that you aren't performing up to your potential, don't hesitate to talk with me, or your advisor, or another faculty member about strategies for success. Most professors have experienced academic life through college, graduate school, and other teaching positions, so we can offer many perspectives on what works and what doesn't work.

5. My exam score was 76, but you wrote 81 as my grade? What does that mean?

When writing an exam, it's hard to adjust its difficulty so that the raw score exactly reflects your knowledge and skill. For this reason, a student can get two different scores on different exams, even if the exams are on the same topics.

How would you compensate for these variations from exam to exam? The classic approach is *rescaling*: find the average score for the class and add (or subtract) enough to everyone's score to make the average equal to 70. I don't like this method because: (a) it makes your individual grade depend on everyone else's performance; and (b) it compares each class against a higher or lower standard from year to year.

My approach is different. After each exam, I sit down and take it myself, but I give myself only half the time. If it takes more time than that to finish it, I add to everyone's score, usually 1 mark per extra minute (more if the standard deviation is high). Since I am the same person from year to year, this procedure ensures that each class is graded by the same standard.

Tentative Schedule

Week	Dates	Topics	Events
1	08/30 – 09/05	Atomic Theory	
2	09/06 – 09/12	Energy in Molecular Systems	
3	09/13 – 09/19	Kinetic Theory	Exam 1 on Friday
4	09/20 – 09/26	Sources of Energy	
5	09/27 – 10/03*	Conversion of Energy	
6	10/05 – 10/10	Entropy	
7	10/11 – 10/17*	Free Energy	Exam 2 on Friday
8	10/18 – 10/24	Equilibrium	<i>(Mole Day on Friday)</i>
9	10/25 – 10/31	Acid-Base Chemistry	
10	11/01 – 11/07	Acid-Base Buffers	
11	11/08 – 11/14	Quantum Chemistry	Exam 3 on Friday
12	11/17 – 11/21	Electronic Structure	
	11/22 – 11/28	Thanksgiving	
13	11/29 – 12/05	Chemical Bonding	
14	12/06 – 12/12	Molecular Structure	
15	12/13 – 12/15*	<i>to be announced</i>	
	12/20	Final Exam on Sunday, 8:30a	Final on Sunday, 8:30a

* During Week 5, there is no class on Monday

* During Week 7, there is no class on Monday (Reading Period)

* During Week 15, Monday is the last day of class