Chemistry 121-05 -- General Chemistry I **Fall 2001**

Peter Kuhlman

Welcome to the fabulous, far-reaching world that is chemistry! This syllabus should help you prepare for what I hope will be an exciting and challenging exploration of chemical concepts this semester.

What my goals are for this course this semester:

- Science and chemistry are processes of inquiry, not static collections of facts. While I certainly want to facilitate your understanding of chemical concepts and the "language" chemists speak, I also want you to come to see chemistry as a *way of learning*. A significant portion of this class will therefore be aimed at helping you to improve your skill in applying chemical logic to the investigation and analysis of your world.
- In the same vein, I want to share with you, and hopefully pass on to you, my passion for the explanatory power of chemistry and its relevance to our daily lives, and the excitement of delving beneath the observable landscape to the fascinating molecular world that forms its fabric.
- I also want to guide you towards a working familiarity with the logical approach to asking questions about your world that we term "the scientific method". This methodology is far more than a set of steps for designing laboratory experiments. It is truly a way of interacting with life and with information. It is the lens through which I view my world.

Fundamental to my approach to this class is a firm belief in the Liberal Arts approach to learning. At its core, this philosophy states that learning is not so much a process of accumulating information as a process of developing ways to examine and make sense of information. Therefore I most decidedly do NOT view my role as teacher to be the person who tells you all there is to know about chemistry. Rather, I strive to be the person who encourages you to think critically about chemical information, who helps you to construct your own view of the chemical world.

Who I am and how to get in touch with me:

Instructor: Peter Kuhlman
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Office hours: I have become dissatisfied with regular Office Hours. It seems that neither of us are well-served if my choice of Office Hours doesn't match your schedule -- you don't get your questions answered and I sit there alone in my office. Instead, I will hold a regular review session *every other Tuesday evening from 6:00 pm until 8:00 pm* throughout the semester (on odd-numbered weeks -- the first, third, fifth, etc), and I will meet with you at other times of your choosing outside of class hours. I will make every effort to ensure that you and I can find a time to meet and discuss any topics that are of concern to you. *I will be available for at least 4 hours of appointments each week*, scheduled by the end of the preceding week.

Course material:

Text: *Chemistry: The Central Science*, by Brown, LeMay, and Bursten (Eighth edition).
Laboratory Manual: *Guide to Experimental Chemistry*, Denison University faculty (Fall 2001 edition).

Course meeting time:

We will meet in Herrick Hall on Mondays, Tuesdays, Wednesdays, and Fridays from 11:30 a.m. until 12:20 p.m. Although we are scheduled for these four days of classroom meetings each week, I will routinely use one of the four days either as a test day, or as a special meeting for those students who have questions or difficulties with the material. Thus we will typically only have three days of new material each week.

In addition, we will meet in the laboratory on Tuesday afternoons from 1:30 until 4:20. For me, as for many scientists, the lab is a wonderful place -- a place to explore new ideas, a place to test to see whether what I think I know is borne out in reality, a place to see cool phenomena unfold. I look forward to helping *you* explore Chemistry with your hands and eyes and mind, and I hope that I will infect you with some of my passion for experimental science.

How we'll achieve the course goals:

It is my experience that the best way to learn is to *read, think, and discuss*. Because I intend to help you *think* chemistry and *learn* chemistry together with your classmates, most of our class meetings will not be conventional lectures. And because it is my fundamental assumption that I am here as your *partner* in learning, I invite you to join me in taking responsibility for your education. For instance, I expect that you, as an experienced student, have learned to read textbooks in a fairly sophisticated fashion, and I will therefore NOT simply re-phrase the material in your readings from the text. Rather, I will expect you to read recommended passages from the text BEFORE coming to class, and I will structure our class time in ways intended to help you review, reinforce, and synthesize the material in the text. I will do some lecturing, we will have both large and small group discussions, and I will at times ask probing questions. There will be opportunities over the course of the term for you to practice making observations and reaching conclusions on the basis of those observations. There will be times when I will ask you to make predictions of the behavior of chemical phenomena on the basis of what you have observed and learned.

Throughout these classroom activities, I will be looking more for evidence that you are trying to learn and trying to think than for evidence that you have the "right" answers. I will ask you for predictions and calculations and observations, *not* to be cruel or "tough", but rather because I believe it is my job to help you *learn to learn* and *learn to think critically*. (Even though I believe that this is one of the most effective ways to help you learn, I am also aware that different people learn best in different ways, so please let me know if you feel uncomfortable with this approach to classroom learning!)

This class format is most effective when every member of the class is engaged. If class members either dominate, distract from, or withdraw from the class, we are all likely to learn less. I will therefore base part of your grade on my evaluation of your contribution to the class discourse. That doesn't mean that you should feel compelled to say a lot in class, or that every comment or answer you give has to be "right". On the contrary, we often learn much more from our mistaken answers than from our correct ones. Accordingly, I will note only whether your comments and answers indicate (a) that you are coming to class prepared and (b) that you are thinking. Of course, this also means that you must generally be present in class (and you must arrive on time), for if you aren't there, it will be difficult for you to contribute to the class and to show me that you're reading and thinking.

More specifically, if you *must* be absent from any laboratory or exam day, please see me beforehand if at all possible, and in any case be prepared to rigorously justify your absence (with supporting documentation from, for example, Student Health or the Academic Support office). Absence on a test date will result in a score of zero for that test if you have not *previously* made an arrangement with me to take the test at another time. You are responsible for all class material whether you are present at all class meetings or not, so be sure to make arrangements with me and with your classmates to obtain the information that we covered in class on any days that you are not present.

I will strive to keep the format and content of this class flexible so that I can respond to your needs and interests as we go through the semester. I agree with past students that such flexibility enhances my ability to make this Chemistry course *your* Chemistry course. I also realize, however, that this very flexibility can be unsettling, and I will therefore also strive to make it very clear what my view of the class structure and priorities are. Furthermore, in order to make changes to the course on the fly, we need to be in ready communication, and so I ask that you make it a habit to check your e-mail *daily* in case we need to be in touch about class-related matters.

Other ways to demonstrate your mastery of chemical concepts There is far more to chemistry than what you will encounter in Chem 121 and 122. In order to encourage you to experience some of the greater world of chemistry, I will give supplemental course credit for up to 4 examples you submit of Chemistry-in-Action. These examples may spring from some phenomenon you observe, something you read, or a seminar you attend (there will be seminars throughout the semester; watch for signs around Ebaugh). In any case, you should clearly describe the chemical principle involved and how it is made manifest in this phenomenon. Your description should be well written, should unfold logically, and should include citations of reputable

sources of information. Ideally, you will be able to include stepwise instructions for a (safe) demonstration of the phenomenon. Chemistry-in-Action essays will be graded on a ten-point scale.

Finally, I think that it is important for you to learn how to decide which of the many, many bits of information that you encounter in this class are more important and which are less important. Similarly, I want to encourage you to reflect on which aspects of the material ***I*** think are important and am apt to stress on exams. To stimulate these kinds of higher-order learning, I'll give you one extra point for every exam question that you predict I will ask. Of course, I don't expect you to come up with the exact questions, but with some work I think that you'll be able to predict the types of questions I'll ask. I will accept up to four of these samples questions for each exam. In order to receive credit for your submissions, you must send me *sample questions and correct answers in plain (unformatted) text by email before the test is administered.*

If you have *any* questions about the course material, you should not hesitate to seek me out before class, after class, or by appointment at another time.

Homework:

I will recommend homework problems from your textbook during most class periods. (Occasionally, I'll send them out by e-mail after class.) These assignments will be designed to help you apply the material that you have read or that we have covered in class, and/or to encourage you to think beyond what you have encountered thus far in the course. These recommended problems are just that: *recommended, not required.* I encourage you to try your hand at them because I believe this will accelerate your learning of chemistry and your exposure to more examples of chemical analysis.

To optimize your benefit from trying these problems, you may submit them to be checked. If you wish to do so, please hand in your homework at the beginning of the class period immediately after the one in which it is recommended, being sure to write your name and Slayter Box number in the upper right-hand corner of each page. Let me reiterate that *homework will be corrected but won't be graded.* My intent is to have you engage the material, to explore it and to struggle with the answers, not to have you get everything right every time. That said, of course, your ability to profit from the homework depends on your learning the difference between right and wrong answers. Accordingly, the Checkers and I will make a sincere effort to provide you with as much feedback as we can, in as timely a manner as we can. Late homework exercises will be corrected at the discretion of the Checker.

Laboratory:

I will hand out a separate lab syllabus with more details on Tuesday, so let me just say here that the laboratory component of this course is an integral part of it. It is your chance to explore with your hands and your senses some of the things you will be exploring with your mind in the classroom. Moreover, the laboratory periods will be an opportunity for you to learn how to test ideas through the design and critical analysis of experiments. As such, the lab is in many ways more important to my goals for the course than is the classroom. And as a result, to pass this course, you MUST complete all laboratory work. Period.

Special Needs

Different students come to this class with different training, different backgrounds, and different abilities. If you feel that because of personal factors you would benefit from some modification of course procedures, such as special test-taking arrangements, I ask that you contact me privately *at your earliest convenience.* I will work with you and with the Academic Support staff (Doane Hall, room 104) to optimize your learning experience. Certain accommodations will require verification of disability based on documentation on file in the Academic Support office.

How will your learning be assessed?

There will be a variety of opportunities for you to demonstrate to me your mastery of course concepts; these will probably add up as follows:

Subjective evaluation of intellectual engagement and contribution to the class		100 pts	11 % of total
Laboratory		235 pts	25 % of total
Exams (6 tests; best 5 count toward final grade)			
	80 pts x 5 =	400 pts	43 % of total
Final exam		200 pts	21 % of total

	TOTAL	935 pts	

Please note:

- Because this class has both important classroom and laboratory components, the following two conditions ***must*** be met for you to receive a passing grade in the class:
  1. You must complete all assigned laboratory work (as noted above).
  2. Your average exam grade (over the five exams and the final) must be greater than 50%.

- Grades will be assigned *roughly* according to the scale below. Note that I may change the scale so that it more accurately reflects what I feel to be the performance of members of the class. For instance, if everyone does poorly on the tests and if I conclude that it is because I did something wrong, then I will likely adjust all grades upward from the following distribution. On the other hand, if I think that the tests are sufficiently challenging but everyone does very well and is earning "A" marks, then I will be pleased as punch and am *un*likely to change the scale. For the most part, you may consider these to be the most demanding standards that I am apt to apply.

88% and up	flavors of A
74 to 88%	flavors of B
60 to 74%	flavors of C
50 to 60%	flavors of D
below 50%	F

- Finally, I wish to make clear my interpretation of letter grades.
  I view an "F" as a strong condemnation of the effort and commitment put forth by a student. I hope not to give your class any "F"s.
  I view a "D" as an indication that a student is performing well below my standards and well below the student's abilities. I hope not to give your class any "D"s.
  I view a "C" as notice that the student is present but not fully motivated or engaged. A "C" student is doing adequately but has not committed the personal resources to the class to effectively learn.
  I view a "B" as a very respectable grade. The student to whom I give a "B" may be trying very hard but still struggling with mastery of the material, or may be working less hard and stopping short of achieving excellence.
  I view a "B+" as an indication that a student is doing a good job. This grade indicates to me that the student is expending significant care and effort to ensure that s/he is learning the material.
  I view an "A-" as a very good grade. I do not give this grade lightly or without evidence that a student is truly approaching mastery of the material, for this grade indicates that a student has met my expectations for the course.
  I view an "A" as an indication of true excellence. In order to achieve an "A" in my course, a student must demonstrate to me that s/he has not only committed the necessary resources to master the material, but also that s/he is aggressively engaging the questions that we explore. This is a grade to be proud of, a grade to be earned by serious work and mental sharpness.

Course Calendar

This is an *approximate* schedule of when we will cover various topics over the course of the semester. I fully expect that the actual schedule will vary from this one in order to accommodate greater coverage of topics where you have greater interest or greater difficulty than I have anticipated. Clearly, this will affect when you should be ready to discuss what material. To minimize the problems that can cause, I will discuss changes to this calendar in class as they arise, and you should make an effort to ask me if you have ANY questions about what material we will be covering at what time.

A separate schedule of laboratory exercises is included in your lab manual.

Week	Day	Date	Reading	Topic
1	M	Aug. 27		Course Introduction: What is Chemistry?
	T	Aug. 28	1.1 - 1.3	Matter
	W	Aug. 29	1.4 - 1.5	Measurements and Significant Figures
	F	Aug. 31		Review and application
2	M	Sept. 3	1.6	Units and unit conversions: computational *power* in a few easy steps!
	T	Sept. 4	2.1 - 2.4	Atomic structure & The Periodic Table
	W	Sept. 5	2.4 - 2.6	Molecular and Ionic compounds
	F	Sept. 7		Review and application
3	M	Sept. 10	2.7	Speaking the language of chemistry, part I: naming Inorganic Compounds
	T	Sept. 11	3.1 - 3.2	Speaking the language of chemistry, part II: Mass balance, chemical equations, and reactivity
	W	Sept. 12		"Seeing" chemical reactions
	F	Sept. 14	**EXAM I**	
4	M	Sept. 17	3.3 - 3.4	Atomic and Molecular Weight; The Mole
	T	Sept. 18	3.4- 3.5	The Mole again; empirical formulas
	W	Sept. 19		Using chemical equations to explain and predict chemical behavior
	F	Sept. 21		Review and application
5	M	Sept. 24	3.6	Stoichiometry
	T	Sept. 25	3.7	Limiting Reagents
	W	Sept. 26	4.1	Aqueous solutions, electrolytes
	F	Sept. 28	**EXAM II**	
6	M	Oct. 1	4.2	Precipitation reactions and Solubility Rules
	T	Oct. 2	4.3 - 4.4	Acid-base reactions, oxidation-reduction reactions
	W	Oct. 3	4.5	Molarity
	F	Oct. 5		Review and application
7	M	Oct. 8	4.6	Concentration and dilution
	T	Oct. 9	5.1 - 5.2	Introduction to the analysis of energy in chemical reactions
	W	Oct. 10	5.3 - 5.4, 5.8	Enthalpy, heats of reaction
	F	Oct. 12	**EXAM III**	
8	M	Oct. 15	(no class)	***Fall Study Break***
	T	Oct. 16	(no class)	***Fall Study Break***
	W	Oct. 17	6.1 - 6.2	Light and atoms
	F	Oct. 19	6.3	Electronic spectra

9	M	Oct. 22	6.4 - 6.7	Quantum Mechanics and electron orbitals
	T	Oct. 23	6.8 - 6.9	Electron Configuration
	W	Oct. 24	7.1 - 7.4	The Periodic Table
	F	Oct. 26	7.5 - 7.7	Periodic trends in elemental properties
10	M	Oct. 29		Review and application
	T	Oct. 30	**EXAM IV**	
	W	Oct. 31	8.1 - 8.3	Ionic Bonds
	F	Nov. 2	8.4 - 8.6	Covalent Bonds
11	M	Nov. 5	8.6 - 8.7	More About Bonds
	T	Nov. 6	8.8 - 8.9	Even More About Bonds
	W	Nov. 7	9.1 - 9.2	Molecular Geometry & VSEPR
	F	Nov. 9		Review and application
12	M	Nov. 12	**EXAM V**	
	T	Nov. 13	9.3 - 9.4	Molecular Geometry and Polarity
	W	Nov. 14	9.5 - 9.6	Hybrid Orbitals & Multiple Bonds
	F	Nov. 16	10.1 - 10.6	Ideal Gases
13	M	Nov. 19	10.7	Kinetic Molecular Theory
	T	Nov. 20	10.8 - 10.9	Kinetic Molecular Theory and *Real* Gases
	W	Nov. 21	(no class)	***Thanksgiving Break***
	F	Nov. 23	(no class)	***Thanksgiving Break***
14	M	Nov. 26		Real gases in action
	T	Nov. 27	**EXAM VI**	
	W	Nov. 28		Applications of the Ideal Gas Law
	F	Nov. 30	11.1 - 11.2	Gases, liquids, & solids; Intermolecular Forces
15	M	Dec. 3	11.3 - 11.5	Intermolecular forces and phase changes
	T	Dec. 4		Predicting physical properties based on molecular structure
	W	Dec. 5		The semester-in-review
	F	Dec. 7		Semester wrap-up, Course Evaluations
Finals week	**F**	**Dec. 14**	**FINAL EXAM at 9:00 am.**	