Syllabus for Chemistry 104 Lec 001, Spring 2016

8:50 AM MWF; 1351 Chemistry

Prof. Clark R. Landis

6112 Chemistry

262-0362

landis104@chem.wisc.edu

Office Hours: M 10:00-12:00 PM or by appointment

Chemistry 104 is the second semester of a two-semester General Chemistry sequence. I assume that students who take Chemistry 104 will have had Chemistry 103, 108, or a similar course and possess fundamental math skills at the level of high school algebra. When appropriate I will point you to readings in the textbook that review concepts that were covered in the previous semester. Completion of Chemistry 104 is required for students who wish to take Analytical Chemistry (Chem 327 or 329). Completion of Chemistry 104, 109, or 116 is required for students who wish to take Organic Chemistry (341 or 343) or Inorganic Chemistry (311).

Textbook and Other Required Material. You will need the following

1. The textbook, *Chemistry: The Molecular Science, (5th edition)*, by Moore and Stanistski. Also you must be registered for the on-line homework system, *OWLv2*.
2. Chemistry 104 Laboratory Manual, Spring 2016, and carbonless laboratory notebook.
3. Safety goggles. Industrial quality eye protection is required in all chemistry laboratories. Safety goggles that fit over regular glasses can be purchased from local bookstores. Contact lenses should not be worn in the laboratory because fumes or splashes may be trapped between them and your eyes.
4. An I-clicker. The lectures will make extensive use of student "voting" on concept tests, surveys, and other questions. You will need to buy a radio-frequency clicker, specifically an I-clicker (not I-clicker2 or web-clicker) and bring it to every lecture. These can be purchased at the University Bookstore.
5. An inexpensive calculator capable of calculating square roots, logarithms and exponential operations. The calculator will be used on exams, homework assignments, and in the laboratory. Any programmable calculator may be used so long as 1) it is allowable for both the ACT and SAT exams and 2) it is only used for simple mathematical calculations and not used to store information such as chemical formulas or equations.

Goals. Chemistry 104 concerns the application of chemical principles such as bonding, molecular structure, thermodynamics, and kinetics to understanding the world around us. In this course you will

- Integrate multiple chemical concepts to understand the "real world"
- Enhance your ability to discuss observable, macroscopic properties as the consequences of interactions that occur at the atomic level
- Become acquainted with the cutting edge of chemistry-related technologies
- Explore the chemistry perspective of *how we know* (e.g., how do we know a buckyball has sixty C atoms?) and *why* (e.g., why do diamonds form in the earth's interior?)
- Relate chemical principles to contemporary issues (e.g., the search for new AIDS treatments)
- Develop comfort with the application of estimation techniques and graphical methods for solving problems and viewing data.
- Prepare yourself for further studies in Chemistry
- Improve your visualization, communication, and writing skills

The Course consists of three *Thematic Units* with subtopics:

I) Solid State and Electronic Structures

A) Buckyballs, Diamond, Graphite

B) Semiconductors

II) Organic Chemstry to Proteins
- A) Hydrocarbon Fuels
- B) Artificial Sweeteners
- C) AIDS and HIV Protease Inhibitors

III) Water Chemistry
- A) Acid Rain
- C) Copper Mining

Course Organization and Expectations. This course emphasizes your active participation in the construction of new knowledge. This means that lectures are interactive, that you will work in groups to solve substantial problems, and that memorization alone will not enable success. You are required to attend lectures, discussion sections, and laboratories. In order to improve our communication and student participation in the learning process, I will meet weekly with an Executive Committee of students.

Much of the material in this course is new and not well represented in textbooks. The course will be augmented with handouts, exercises on the World Wide Web, videocasts, etc.

Success in the class requires you to communicate your thoughts effectively. If you would like to enhance your writing skills contact the Writing Center (www.wisc.edu/writing, room 6171 Helen C. White Hall, 263-1992; check the web site for hours and more information).

If you find that your learning needs are not being met or you are not satisfied with some aspect of the course please bring your concern to your professor or your TA.

It is essential that you apply good study and time management skills. A recommended study strategy for this course is: 1) read the assigned material in the text and lecture "Pre-Notes" before each lecture, 2) attend class and take your own notes, 3) start work through on-line homework problems at least four days before they are due. When you encounter problems that you cannot solve, refer to the text, your notes, a tutorial, or your fellow students. Forming a study group to work through problems is an excellent way to learn chemistry. Group problem sessions will be stressed throughout the semester.

This course comprises a range of activities that are aimed at facilitating the learning process. These activities are described below.

Lectures. You are expected to attend all lectures. During lectures we will discuss principles of chemistry and illustrate them with examples and demonstrations. We will make frequent use of in-class "ConcepTests" for which you will use your electronic i-Clickers to vote for answers and, following discussions with your neighbors, revise your votes. You should take your own notes during lecture. If you would like some pointers on good note taking habits, we recommend that you visit this site. In addition, a set of lecture notes taken by a Teaching Assistant (TA) will be available on Learn@UW. Presentations will use several media. Electronic "PreNotes" can be downloaded from the course web page the night before each lecture. See page the course web site for the lecture schedule

Lecture Demonstrations. Many chemical reactions and other phenomena are sufficiently dangerous or expensive that it is not practical for all students to experience them first hand. Nevertheless, such reactions may illustrate important principles or facts. When a demonstration is done in class, make careful observations of what happens and make certain that you understand the principles the demonstration is designed to illustrate. Demonstrations are

important, and questions about observations or principles that have been presented via demonstrations often occur on exams.

Textbook. Although this course does not follow the sequence of the book, the textbook provides deeper background material for the lectures and also works out many relevant examples. In addition, the book provides many problems and solutions. For an understanding of the material in this course it is important to solve as many of these problems as possible. You must have a textbook (electronic is satisfactory) and access to *OWLv2*, the on-line collection of problems, homework assignments, and tutorials.

Discussion Section. You have been assigned to a discussion section, comprising 22 or fewer students, under the supervision of a teaching assistant (TA). You are expected to attend all scheduled discussion section meetings. You will work with your TA and section classmates on material covered in lecture, text material, problem sets, and laboratory experiments. This is an opportunity for you to discuss the course material informally and to work in groups on exercises.

Laboratory. In laboratory you will have the opportunity to explore some of the concepts discussed in lecture. The goal of the laboratory is to develop useful laboratory skills, to observe chemical and physical properties of matter first-hand, and to learn how measurements are made and interpreted. *You must successfully complete the laboratory assignments to receive a passing grade in this course*. You should prepare in advance for each laboratory exercise by writing up an introduction and procedural outline in your lab notebook. During the lab period you will carry out the experiment, take notes, and complete your data analysis. Please note that **late** laboratory reports are not graded. The schedule of labs is given in the course outline provided below.

PreLecture Problem Sets. We have developed tutorial packages that will help you to develop your skills at applying chemistry concepts and expressing them. These must be completed ***before 11 PM*** of the night before lecture.

Grading. All grading is done on an *absolute* scale. Helping another student cannot hurt your grade, but will enhance your learning. This system allows you to assess your own standing at any time in the course by simply computing the fraction of total points possible that you have received at that time. There are 1000 points total in this course.

Exams		
Midterms (3 written, 3 multiple choice)	75 points each	450 points
Comprehensive Final	150 points	150 points
i-Clicker Responses		70 points
Laboratory		
12 laboratory grades	20 points each	240 points
PreLecture Activities		
30 Activities	3 points each	90 points
TOTAL		1000 points

A total of 900 points or higher *guarantees* an “A”; 860 or better an “AB”; 810 points or better guarantees a “B”; 760 points or better a “BC”; 700 points or better, a “C**”. You must complete the laboratory portion of this class to pass the course.**

Exams. There will be three mid-term exams, all given on Friday mornings in lecture. Each exam has two parts given on consecutive weeks: multiple choice and written. These exams count for about one-half of your total grade. The multiple-choice exams, given during the class period (see course outline for dates), are based on material presented in lectures and homework problems. Exams may also include questions based upon laboratory material. No make-up exams will be given. The written part of the exam occurs the week following the multiple choice exam. The written exam will require you to synthesize ideas you have learned over the entire course in order to better cement the connections between basic chemical principles and the topical themes that are interwoven throughout the course. In the week before each written exam, we will give you preparatory problems to work out with study groups.

Cooperative Learning and Group Work. Learning depth and quality improve when problems are worked in groups and when problem solutions are explained, critiqued, defended and modified. We expect that you will work on problems and laboratory experiments with your peers. However, all materials that you submit for grading *must be written in your own words*. Plagiarism will not be tolerated.

Final Exam The two hour final exam is comprehensive, covering topics from the entire semester. ***The Final Exam for Chem 104 – LEC001 is Sunday, May 8, 2014 at 10:05 AM.***

Themes. Chemical concepts enhance our understanding of many urgent societal issues. We will emphasize consistently the relationship of small molecule properties to more general themes of current interest. Supplementary reading materials and videocasts will be provided to help you link chemistry concepts with broader topics.

Resources. Your best source of information is your teaching assistant. They understand what it takes to succeed in this course and are trained professionals who can help you navigate this semester. The Greater University Tutoring Service (GUTS) offers free assistance to any student in this class via a variety of programs. These include study group tutoring, individual tutoring, study skills counseling. The chemistry fraternity AXE also provides free tutoring as do many of the First year Residence Halls. You can meet with the professors after class, during their office hours, or by setting up an appointment by email.

Technology Enhanced Learning. Much of the material for this course is only available via Learn@UW. You are urged to visit the web site routinely for up to date class information. You have access to the 104 materials via Learn@UW only if you are enrolled in this course. You can use Learn@UW on your own computer, a friend's computer, or any other computer on campus. Direct your Web browser to https://learnuw.wisc.edu/ and log in. You will be asked for your NetID Username and Password. If you have a problem logging in, and you have been registered for this section of Chem 104 for at least two days, send an email to rbain@chem.wisc.edu. Please log in to Chemistry 104 in Learn@UW as soon as possible.

Wk	Date	Lect	Topic	Laboratory	Assignment
1	21-Jan	1	Buckyballs, Diamond, and Graphite (Solid Structures and Phases)	No Lab	1 PreLecture
		2			
2	25-Jan	3	Buckyballs, Diamond, and Graphite (Equilibria, LeChatelier, and Enthalpy)	Modeling Solid Structures	3 PreLecture
		4			
		5			
3	1-Feb	6	BD&G (Entropy, Free Energy, Diffraction)	Optical Transforms	3 PreLecture
		7			
		8	Semiconductors and LEDs (Phases, Kinetics, Conductivity)		
4	8-Feb	9	Semiconductors and LEDs (Bands)	LEDs	2 PreLecture
		10			
			In Class Exam (Mult Choice)		
5	15-Feb	11	Semiconductors and LEDs (Light, Periodicity, Dopants)	Molecular Structures	2 PreLecture
		12			
			In Class Exam (Written)		
6	22-Feb	13	Fuels and Addititves (Valency, Isomers, Structures, Energy, NMR, Chromatography)	Tylenol	3 PreLecture
		14			
		15			
7	29-Feb	16	Artificial Sweeteners & Polymers (MS, Functional Groups, Condensation)	LeChatelier	3 PreLecture
		17			
		18			
8	7-Mar	19	Polymers (Addition, Stereoisomers)	Biodiesel	2 PreLecture
		20			
			In Class Exam (Mult Choice)		
9	14-Mar	21	HIV Protease (Structure, H-bonding, Acid/Base)	Neutron Activation	2 PreLecture
		22			
			In Class Exam (Written)		
10	21-Mar	***Spring Break***			
11	28-Mar	23	HIV Protease (Kinetics, Catalysis, Mechanism)	CE&T	3 PreLecture
		24			
		25			
12	4-Apr	26	Acid Rain (Weak/Strong Acids and Bases, pH, pK_a, pK_b, Quantitative Analylsis)	Acids/Bases	3 PreLecture
		27			
		28			
13	11-Apr	29	Acid Rain (Functional Groups, Titrations, Indicators, Buffers) Cu Mining (Electrochemistry)	Redox Titrations	3 PreLecture
		30			
		31			
14	18-Apr	32	Cu Mining (Electrochemical reactions, Standard Potential)	Electro-chemistry	2 PreLecture
		33			
			In Class Exam (Mult Choice)		
15	25-Apr	34	Cu Mining (Entropy, Concentration Cell, Coulometry)	Cu Ammine	2 PreLecture
		35			
			In Class Exam (Written)		
16	2-May	36	Cu Mining (Equilibria)	No Lab	
		37			
		38	Review		
Final Exam May 8, 10:05AM- 12:05PM (locations to be determined)					