

University of Massachusetts Boston  
College of Science and Mathematics

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| CHEM 115 | CHEMICAL PRINCIPLES I<br>Spring, 2008 | SYLLABUS |
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| <b>Instructor</b>                  | Hannah Sevian, Ph.D., physical chemistry<br>Associate Professor, Chemistry (CSM) and Science Education (GCE) |
| <b>Office Telephone</b>            | 617-287-7724   |
| <b>E-mail</b>                      | hannah.sevian@umb.edu  |
| <b>Time and Location of Course</b> | Tu/Th 2:30 - 3:45, S/1/003 (Lipke Auditorium)  |
| <b>Office Hours</b>                | Tu/Th 4:00 - 5:00  |
| <b>Office Location</b>             | Wheatley 4 <sup>th</sup> floor, room 181   |

Although I do have set office hours, I encourage you to seek assistance from me at other times as well. Email is the best way to reach me, and I always respond to questions sent by email. If you would like to arrange an appointment outside of office hours, please email me. If you do not have easy access to email and if you are unable to reach me directly by phone, you can also reach me through my administrative assistant at 617-287-7587.

All information concerning this course is available on the course website, which can be linked to from [www.chem.umb.edu](http://www.chem.umb.edu), and which you should visit frequently.

### Course Description

Introduction to the fundamental principles of chemistry including atomic structure, stoichiometry, the periodic table of the elements, chemical bonding, molecular structure, and states of matter based on kinetic theory. Laboratory work presents an introduction to methods of quantitative chemical techniques. This course is intended for majors in any of the sciences, including pre-dental, premedical, and pre-engineering students. Note: Chem 115 (lecture + discussion) and Chem 117 (lab) are co-requisite courses, so you should be enrolled in both, unless you have already taken and passed Chem 117 or the equivalent elsewhere.

### Course Prerequisites

You must have passed Math 115 or have passed the Math Placement Test for Math 130. The reason this course has a strictly enforced mathematics prerequisite is that lack of proficiency with algebraic manipulations is widely recognized as one of the key elements in failure in general chemistry. Students who have passed a college course in pre-calculus algebra and analytical geometry (equivalent to our Math 130) or higher mathematics courses (calculus, etc.) are exempt from this requirement. If this work was taken at another university, you may be asked to provide documentation before being signed into the course, unless UMass Boston has accepted your previous courses for transfer credit. Please note that students who have taken a statistics course (e.g., Math 125) but no higher mathematics courses *are not exempt* from this prerequisite. If you have enrolled in this course without having met the math prerequisites, please drop the course.

### Required Texts

- Brown, LeMay & Bursten, Chemistry: The Central Science, 10<sup>th</sup> ed. The book is available in the bookstore as a special bundle that includes online access to the Student Solution Manual to the text.
- Eubanks & Eubanks, ACS General Chemistry Exam Official Study Guide. Available at the bookstore.

### Other Required Materials

A scientific calculator (capable of calculating logarithms, square roots, non-integer exponents). Bring this with you to every lecture, lab, and discussion section. Please note that graphing calculators that are capable of communication are not allowed on exams.

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## Course Structure

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There are two components to the 115 course: lecture and discussion. You are required to co-register for the lab (Chem 117), unless you have received advance permission due to having taken it already.

### Lecture

The lectures, not the book, constitute the principal source of material for the tests. It is imperative that you attend lectures, participate in class, and take good notes, and keep up on the reading and homework. If you miss a lecture, you should arrange to get notes from a classmate. The lecture slides that are posted on the course website are not a good substitute for notes taken during lecture because they are missing the explanations and worked problems. In addition to mastering the lecture material, you will occasionally be required to learn material from the book which is not presented in lecture. I will be clear about what material from the book you will be responsible for. Use the book to complement the lectures.

Examinations ask you to demonstrate your mastery of the material through both qualitative (concept-based) and quantitative (calculation- or model-based) problems. It is not enough to understand the concepts of chemistry; you must also be able to apply the concepts to solve chemical problems. There is no other way to learn chemistry than to practice it. To master the material, you must do the homework. One of the best ways to prepare for examinations is to try to solve problems like those assigned for homework or similar to problems solved in class, some of which come from the text book or from the ACS exam study guide.

As often as once a week in class, we will engage in collaborative problem solving, which will count toward your grade. The problems solved will only be presented in class (not in the lecture notes). These "group problems" can help your understanding of chemistry, and your grade, in several ways. The problems allow you to practice problem solving in class. Similar problems will show up on exams. A portion of the points in the course (50 points) is awarded for group problems. When you are present on a day that a group problem happens in class, as long as you and your group make a good faith effort on the problem you will receive full or nearly full credit for the problem. At the end of the semester, your lowest group problem grade will be dropped. Thus, it is quite easy to get a 50 out of 50 for the group problem grade.

### Discussion

Discussion sections are intended to give you opportunities to deepen your understanding of the material, to explain homework problems, and to prepare you for the exams. Homework is not collected or graded, and worked-out answers are available on the publisher's website. You need to register to gain access to this site, using the code on the card bundled with your textbook. Although you will not turn in your homework, you should always attempt to do the assignments before attending discussion. Attendance in discussions will be taken. If you cannot attend your regularly scheduled discussion section, you may attend another section the same week. You may miss three discussion sessions without penalty, but each subsequent absence will result in a 10-point deduction from the 50 point maximum for discussion. Attendance will be taken at discussions beginning the week of February 4. Starting after the first exam, if you received a score of 70 or higher on the exam and if you are easily able to complete a homework assignment and do not have any questions, you will be allowed to receive credit for attending discussion **if** you arrive to your regularly scheduled discussion section five minutes prior to the beginning and show the discussion instructor your completed homework. The discussion instructor will check one or two problems on the homework, and if they are correct, you will be given the option of signing in and receiving credit for that discussion section but you do not have to attend it. For the sake of the students who attend the discussion, the instructor will begin discussion promptly at the scheduled start time, and will not permit this option after discussion begins.

### Optional Facilitated Study Group (FSG)

Thanks to a grant from the National Science Foundation, the university is offering facilitated study groups for students in Chem 115. Study groups will meet once per week for one hour, and will be facilitated by a chemistry graduate student who is experienced at teaching chemistry and has been trained as a study group facilitator. Students who elect to participate in an FSG must commit to attending it every week. The goals of the FSG are to provide students with the opportunity to work collaboratively to solve difficult chemistry problems, foster friendships based on common academic interests, and create an environment

where students inspire each other to maintain a high level of commitment to excellence. FSG's will begin the week of Feb 4, after polling the class to determine the most optimal times to schedule the FSG's.

### Laboratory

The laboratory schedule and instructions for the individual experiments are available from the website under the heading "Laboratory." The Laboratory is a separate course, Chem 117. Please contact your laboratory instructor to discuss any matters (e.g., absences) related to the Laboratory.

### Calculator Policies

Calculators may be used in all aspects of this course, including exams. A simple scientific calculator will suffice for Chem 115, but in Chem 116 you may find it useful to have a more sophisticated calculator, such as the Texas Instruments TI-86 or similar models. **During exams you may not use any calculator or device that is capable of communicating with any other calculator or device.** For example, you may not use graphing calculators, Palm Pilots, cell phones, or similar devices during exams. Anyone using such a device on an exam will receive a zero for the exam. Be sure you know how to operate your calculator before you have to use it in a test situation. Before arriving to an exam, be sure your calculator is working properly and that it has fresh batteries (if needed) or will work in low light (if solar powered). You may bring a backup calculator to exams, if you would like. **Calculator sharing is not allowed during exams.**

### Tests and Academic Honesty

**Except in highly unusual circumstances, there are no make-up examinations.** The dates for the exams are listed at the end of this syllabus and are also posted online in the calendar. Exams will be given during the normal lecture time. There are three mid-term exams in the course, and one of them is dropped when calculating the course grade. If you are unable to attend one of the exams, this will most likely be the exam that is dropped. If you are tardy for an exam for a legitimate reason (e.g., car accident on the way to the university) you must call me or send an email in advance of the exam or as soon as possible under the circumstances. In cases of real emergency, you *might* be eligible to start the exam late. *Absence without notice and/or legitimate cause will result in a score of zero for the exam.* Make every effort to arrive on time to each exam. If you arrive late, you will not be given extra time, except in special circumstances. **No one arriving late to an exam will be allowed to take the exam after the first paper has been handed in, unless special arrangements have been made in advance.** Although your lowest exam score will be dropped in determining your final grade (see Grading Policies below), you are strongly encouraged to take every exam.

**During exams you are allowed to have pencils, erasers, and your calculator (with extra batteries, if needed) – nothing else.** You may *not* have notes, open books, or scrap paper. You are not allowed to bring your own scrap paper to the exam; scrap paper will be provided at the exam. You are not allowed to store course information in your calculator to use as an electronic "cheat sheet." Where indicated, you must show work that leads to the answers you give. This means that the correct answer with no work, or work that does not logically lead to it, receives zero credit. Your work must be your own, with no assistance received from anyone else. You should also take reasonable precautions to ensure that no one copies from you. **Academic dishonesty will not be tolerated and may result in your failing the exam, failing the course, or being expelled from the University, depending on the circumstances.**

The final exam for this course will be the official American Chemical Society exam. For this reason, the ACS study guide is one of the required texts for the course, and there will be homework problems assigned from it. You are strongly encouraged to use the study guide to prepare for exams.

### Grading Policies

Grades are based on the following sum of points:

|  | <u>Points possible</u> |
|--|------------------------|
| Best two of three in-class exams (100 points each) | 200                    |
| Comprehensive final exam                           | 200                    |
| Collaborative problem-solving (in class)           | 50                     |
| Discussion attendance                              | 50                     |
| <hr/>  |                        |
| Total points possible:                             | 500                    |

The course is not graded on a curve. Grades will be based on the following percentages (rounded to the nearest integer percentage point):

| Percentage range | Grade range |
|------------------|-------------|
| 90-100           | A           |
| 80-89            | B           |
| 70-79            | C           |
| 60-69            | D           |
| 0-59             | F           |

No student receiving less than 60% of the possible points should expect a passing grade, with the following exception: any student who receives 60% or better on the final examination will receive a grade of at least D-. Grades of INC (incomplete) will only be awarded if (a) a student is passing the course, *and* (b) the reason the student cannot complete the course is beyond the student's control.

### Accommodations

Section 504 and the Americans with Disabilities Act of 1990 offers guidelines for curriculum modifications and adaptations for students with documented disabilities. If applicable, students may obtain adaptation recommendations from the Ross Center (617-287-7430). The student must present these recommendations to and discuss them with each professor within a reasonable period, preferably by the end of the Drop/Add period.

[Students are required to adhere to the Code of Student Conduct, including requirements for academic honesty, delineated in the University of Massachusetts Boston Graduate Studies Bulletin, Undergraduate Catalog, and relevant program student handbook(s).]

*This syllabus is subject to change. Instructions given in class supercede syllabus content.*

### Homework

We will cover chapters 1 through 9 in the text. Please see the "Assignments" section of the course website for detailed weekly reading and homework assignments. Be sure also to download and print out the Course Calendar and other relevant postings under the "Information" section on the website. Sample exams, reference tables, examples of problem solving strategies, and other useful information are also posted on the website.

Detailed homework assignments are posted each week on the course website.  
[www.chem.umb.edu](http://www.chem.umb.edu)

### Examination Schedule

| Exam       | Chapters Covered (approximation*)           | Date                    |
|------------|---|-------------------------|
| Test 1     | ch. 1-3 and sections 4.1 & 4.2              | Thursday, February 28   |
| Test 2     | remainder of ch. 4, ch. 5                   | Thursday, April 3       |
| Test 3     | ch. 6-7                                     | Thursday, May 1         |
| Final Exam | ch. 8, 9 and all the other chapters as well | As officially scheduled |

\*More specific and up to date information (if there are any changes from above) on which chapters and sections within chapters covered on exams will be provided in the study guides for each exam, which will be posted on the course website.

### Order of Topics Covered and Corresponding Sections in Text

I intend to cover the following topics associated with the chapters and sections listed below from the Brown, LeMay & Bursten, 10<sup>th</sup> ed. text. The lectures, not the book, constitute the principal source of

material for the tests. Use the book to complement the lectures. See section on Lectures on p. 2 of this syllabus for more information on this.

| <b>Topic</b>                           | <b>Chapters &amp; Sections in Brown et al.</b>     |
|--|--|
| Matter & measurement                   | Chapter 1 (all sections)                           |
| Atoms, molecules & ions                | Chapter 2 (all sections)                           |
| Stoichiometry                          | Chapter 3 (all sections)                           |
| Aqueous reactions & solution chemistry | Chapter 4 (all sections)                           |
| Thermochemistry                        | Chapter 5 (omit section 5.8)                       |
| Electronic structure of atoms          | Chapter 6 (all sections)                           |
| Periodic properties                    | Chapter 7 (sections 7.1-7.6)                       |
| Chemical bonding, molecular geometry   | Chapters 8 (all sections) and 9 (sections 9.1-9.7) |

**Chem 115 – Section 1**  
**Course Calendar**  
**Spring 2008**

Lecture meets every Tu/Th 2:30-3:45pm, in S/1/03 (Lipke), and is not noted on this schedule  
 The Discussion number noted on the calendar corresponds to the Homework Assignment number.

Discussion sections meet either

- Tu 11:30 in S/2/64 (section 1)
- Th 11:30 in S/2/62 (section 2), or
- F 1:30 in S/2/63

Lab is a co-requisite, and is a separately scheduled course (Chem 117) with its own instructors. Labs are on M 12:30-4:30, Tu 9:00-1:00, and W 12:30-4:30. If you miss a lab, you must contact the lab instructor (not Prof. Sevian) to make arrangements for how to make it up that same week. Labs are listed in the course calendar below to help you with planning.

| Monday  | Tuesday  | Wednesday      | Thursday   | Friday               |
|---|--|----------------|--|----------------------|
| 1/28  | 1/29<br><i>First day of class</i><br>No discussion<br>Properties of matter and mathematical problem solving in chemistry (ch. 1) | 1/30<br>No lab | 1/31<br>No discussion<br>Structure of atoms (ch. 2)                      | 2/1<br>Discussion 1  |
| 2/4<br>Lab 1 (Length & volume)<br><i>Add/drop ends</i>        | 2/5<br>Discussion 1<br>Lab 1<br>Molecular & ionic compounds (ch. 2)  | 2/6<br>Lab 1   | 2/7<br>Discussion 1<br>Chemical nomenclature (ch. 2)                     | 2/8<br>Discussion 2  |
| 2/11<br>Lab 2 (Mass & density)                                | 2/12<br>Discussion 2<br>Lab 2<br>Moles & masses (ch. 3)  | 2/13<br>Lab 2  | 2/14<br>Discussion 2<br>Chemical equations & stoichiometry (ch. 3)       | 2/15<br>Discussion 3 |
| 2/18<br>No labs this week<br><b>President's Day (holiday)</b> | 2/19<br>Discussion 3<br>No lab<br>Limiting reagents (ch. 3) & Solutions (ch. 4)  | 2/20<br>No lab | 2/21<br>Discussion 3<br>Precipitation rxns & net ionic equations (ch. 4) | 2/22<br>Discussion 4 |
| 2/25<br>Lab 3 (Rxns of Cu)                                    | 2/26<br>Discussion 4<br>Lab 3<br>Review for Exam 1   | 2/27<br>Lab 3  | 2/28<br>Discussion 4<br><b>Exam 1 in class</b>                           | 2/29<br>Discussion 5 |
| 3/3<br>Lab 4 (Composition of a mixture)                       | 3/4<br>Discussion 5<br>Lab 4<br>Redox rxns & molarity (ch. 4)  | 3/5<br>Lab 4   | 3/6<br>Discussion 5<br>Acids, bases & pH and titrations (ch. 4)          | 3/7<br>Discussion 6  |
| 3/10<br>Lab 5 (Concentrations)                                | 3/11<br>Discussion 6<br>Lab 5<br>Temperature & heat energy (ch. 5)   | 3/12<br>Lab 5  | 3/13<br>Discussion 6<br>Energy in chemical systems (ch. 5)               | 3/14<br>Discussion 7 |
| SPRING BREAK (March 15-23)                                    |  |                |  |                      |

| Monday   | Tuesday  | Wednesday  | Thursday   | Friday                |
|--|--|--|--|-----------------------|
| 3/24<br>Lab 6 (Five unlabeled bottles)<br><i>Mid-semester</i>                              | 3/25<br>Discussion 7<br>Lab 6<br>Calorimetry & Hess's law (ch. 5)                  | 3/26<br>Lab 6                                      | 3/27<br>Discussion 7<br>Radiation and waves (ch. 6)                            | 3/28<br>Discussion 8  |
| 3/31<br>No lab   | 4/1<br>Discussion 8<br>No lab<br>Review for Exam 2                                 | 4/2<br>No lab                                      | 4/3<br>Discussion 8<br>Exam 2 in class   | 4/4<br>Discussion 9   |
| 4/7<br>Lab 7 (Heats of rxn)  | 4/8<br>Discussion 9<br>Lab 7<br>Spectroscopy & the QM model (ch. 6)                | 4/9<br>Lab 7                                       | 4/10<br>Discussion 9<br><i>Pass/fail deadline</i><br>Quantum mechanics (ch. 6) | 4/11<br>Discussion 10 |
| 4/14<br>Lab 8 (Volumetric Fe analysis)   | 4/15<br>Discussion 10<br>Lab 8<br>QM and periodic trends (ch. 7)                   | 4/16<br>Lab 8                                      | 4/17<br>Discussion 10<br>Explaining periodic trends (ch. 7)                    | 4/18<br>Discussion 11 |
| 4/21<br>No labs this week<br>Patriot's Day (holiday)<br><i>Fall 08 registration begins</i> | 4/22<br>Discussion 11<br>Ionic & molecular bonding (ch. 8)                         | 4/23<br>No lab                                     | 4/24<br>Discussion 11<br>Lewis structures & electronegativity model (ch. 8)    | 4/25<br>Discussion 12 |
| 4/28<br>Lab 9 (Spectra)<br><i>Spring 06 registration begins</i>                            | 4/29<br>Discussion 12<br>Lab 9<br>Review for Exam 3                                | 4/30<br>Lab 9                                      | 5/1<br>Exam 3 in class<br>Discussion 12  | 5/2<br>Discussion 13  |
| 5/5<br>Lab 10 (Molecular shapes)   | 5/6<br>Discussion 13<br>Lab 10<br>Molecular geometry & valence bond theory (ch. 9) | 5/7<br>Lab 10                                      | 5/8<br>Discussion 13<br>Valence bond vs. molecular orbital theories (ch. 9)    | 5/9<br>Discussion 14  |
| 5/12<br>No lab   | 5/13<br>Discussion 14<br>No lab<br>Course review (ch. 1-9)                         | 5/14<br>No lab<br><i>Last day of UMass classes</i> | 5/15<br>Study period   | 5/16<br>Study period  |
| 5/19   | 5/20   | 5/21   | 5/22   | 5/23                  |
|  |  |  |  |                       |