

# CHEMISTRY C117

## PRINCIPLES OF CHEMISTRY AND BIOCHEMISTRY I

Department of Chemistry, Indiana University, Bloomington

Fall, 2009

### LECTURE INSTRUCTORS

Lane A. Baker                      Office: Simon Hall 102A  
Telephone: 856-1873  
Office Hours (held in Chemistry 046):  
Wednesday, 1:30–4:00 p.m.  
Email: bake@indiana.edu

Dennis G. Peters                      Office: Chemistry A162A  
Telephone: 855-9671  
Office Hours (held in Chemistry 046):  
Tuesday, 1:15–3:45 p.m.  
Email: peters@indiana.edu

### LABORATORY INSTRUCTOR

Todd A. Stone                      Office: Simon Hall 005A  
Telephone: 856-7505  
Office Hours (held in Chemistry 046)  
Tuesday and Thursday, 10:00–  
11:00 a.m.  
Email: tstone@indiana.edu

### ASSOCIATE INSTRUCTORS (OFFICE HOURS LISTED BELOW ARE ALL IN CHEMISTRY 046)

Discussion Sections:

Ryan Biczó	rbiczó@indiana.edu	R, 11:00 a.m.–12:00 noon
Alicia Friedman	akfriedm@indiana.edu	T, 10:00–11:00 a.m.
Amanda Lear	amlear@indiana.edu	R, 2:00–3:00 p.m.
Indranil Mitra	imitra@indiana.edu	T, 11:00 a.m.–12:00 noon
Nicholas Pierson	napiero@indiana.edu	M, 12:00–1:00 p.m.

CLASS MEETINGS    8:00–8:50 a.m. or 9:05–9:55 a.m., Monday, Tuesday, Wednesday, and  
Friday, Chemistry 122

## COURSE MATERIALS

**Required:** J. W. Moore, C. L. Stanitski, and P. C. Jurs, “**Chemistry: The Molecular Science,**” third edition, Thomson Learning: Brooks/Cole, Stamford, CT, 2008.

**Required:** N. Dean, C. Reck, T. Stone, J. Robinson, and K. Arnold, “**Chemistry C117: Principles of Chemistry and Biochemistry, Laboratory Manual,**” seventh edition, Hayden-McNeil Publishing, Plymouth, MI, 2008.

**Required:** calculator, safety goggles, and student clicker (eInstruction version)

**Recommended:** J. Z. Ozment, “**Student Solutions Manual for Chemistry, The Molecular Science,**” third edition, Thomson Learning: Brooks/Cole, Stamford, CT, 2008.

**Recommended:** M. J. Sanger, “**Study Guide for Chemistry, The Molecular Science,**” third edition, Thomson Learning: Brooks/Cole, Stamford, CT, 2008.

## DISCUSSION SECTIONS

<u>Section</u>	<u>Time</u>	<u>Room</u>	<u>Associate Instructor</u>
1754	M, 10:10–11:00 a.m.	BH 344	Alicia Friedman
1755	F, 10:10–11:00 a.m.	WH 008	Indranil Mitra
1756	M, 3:35–4:25 p.m.	BH 109	Amanda Lear
1757	T, 5:45–6:35 p.m.	BH 219	Nicholas Pierson
1758	T, 5:45–6:35 p.m.	BH 245	Ryan Biczko
1759	T, 3:35–4:25 p.m.	JHA 100	Amanda Lear
1760	R, 5:45–6:35 p.m.	BH 219	Nicholas Pierson
1761	W, 12:20–1:10 p.m.	BH 305	Ryan Biczko
1762	F, 10:10–11:00 a.m.	LI 031	Alicia Friedman
1763	F, 11:15 a.m.–12:05 p.m.	LI 031	Indranil Mitra
1764	W, 3:35–4:25 p.m.	KH 312	Nicholas Pierson
1765	F, 12:20–1:10 p.m.	SW 218	Indranil Mitra
1766	M, 12:20–1:10 p.m.	BH 305	Ryan Biczko
9778	W, 10:10–11:00 a.m.	BH 003	Alicia Friedman
10958	W, 4:40–5:30 p.m.	SW 219	Amanda Lear

Room Locations: BH = Ballantine Hall; WH = Woodburn Hall; JHA = Jordan Hall Addition; LI = Main (Wells) Library; KH = Kirkwood Hall; SW = Swain West

## GRADING

Grades will be based on the total points earned (up to a maximum of 1300 points) during the semester on (a) examinations, (b) quizzes, (c) CALM homework problems, (d) laboratory safety exercise, (e) laboratory lecture participation, (f) prelaboratory assignments, (g) laboratory reports, and (h) laboratory final examination. Specific point values for the various categories above are given on the following page:

<b>Examinations</b> (drop the lowest night exam or one-half of final exam)	500 points
4 night examinations (100 points each)	
final examination (200 points)	
<b>Lecture Quizzes</b> [6 unannounced quizzes (20 points each, 1 dropped)]	100 points
<b>CALM</b>	100 points
<b>Discussion Section Quizzes</b> [6 unannounced quizzes (20 points each, 1 dropped)]	100 points

The laboratory portion of C117 will have several components, namely:

<b>Laboratory</b>	<b>Points</b>
Safety and Skills Exercise	<b>15</b>
Laboratory Lecture Participation (11 @ 4 points, drop lowest)	<b>40</b>
Prelaboratory Assignments (11 @ 7 points, drop lowest)	<b>70</b>
Formal Laboratory Reports (11 @ 25 points, drop lowest)	<b>250</b>
Laboratory Final Examination	<b>125</b>
<b>Total Laboratory Points</b>	<b>500</b>

***NOTE: Missing three or more laboratory periods or failing to submit three or more laboratory reports will result in an automatic grade of F for C117.***

### **ATTENDANCE**

Attendance is required at all lectures, discussion sections, and laboratory sections. Experience has shown, often in dramatic fashion, that your performance in this course will depend critically upon your attending all class meetings. Even though a rather detailed week-by-week syllabus of assigned reading is available, you will discover that various topics will be treated or emphasized in ways that complement rather than mimic the text. Only by attending lectures and discussion sections and by taking notes can you succeed in mastering the material in this course.

### **POLICY ON ABSENCES**

An **unexcused absence** for any examination, quiz, or laboratory assignment results in an automatic score of zero. An **excused absence** may be granted by one of the course instructors. An **excused absence** is only granted for a university function or a religious holiday. If you anticipate that you will have an **excused absence, you are required to make arrangements at least 1 week in advance of the date of the assignment to be missed.**

### **ACADEMIC DISHONESTY**

As a college student, you are required to uphold high standards of academic integrity and honesty. Plagiarizing the work of fellow students or authors and cheating on examinations, quizzes, or laboratory assignments are a discredit to you, your fellow students, and Indiana University. **The standard penalty for cheating is a grade of F for the entire course!** Be aware that laboratory work is meant to be an individual effort and that students collaborating on laboratory reports are guilty of cheating. Copying the work of other students invokes severe penalties. Students caught cheating will be dealt with according to the Code of Academic Ethics described in the Schedule of Classes.

## EXAMINATIONS

There will be **four Wednesday evening examinations**, each worth 100 points, scheduled from 7:15–9:15 p.m. on September 23, October 21, November 11, and December 2. Each examination will be designed to test your knowledge and understanding of the material covered in the lectures prior to that examination. For students with unavoidable time conflicts, there will be an early examination time (5:00–7:00 p.m.) available for each of the four Wednesday evening examinations; **you must sign up in advance to take an early examination.**

A **laboratory final examination**, worth 125 points, will be given on Wednesday, December 9, from 6:50–9:30 p.m., with an early examination from 4:00–6:30 p.m. on the same day.

A **final examination**, worth 200 points, will be given on Wednesday, December 16, from 12:30–2:30 p.m. Although this examination will be comprehensive (covering all aspects of the semester's work), there will be extra emphasis on material dealing with the last two weeks of the semester.

Prior to the above examinations, announcements will be posted to indicate the rooms where the examinations will be given. **No make-up examinations will be given. If you miss an examination, your score will automatically be zero.**

## QUIZZES

Throughout the semester, a total of 12 **unannounced** short quizzes will be given; 6 of these quizzes will be given in the main lecture sections, and 6 of these quizzes will be given in the weekly discussion sections. These quizzes, which may consist of a combination of multiple-choice items and numerical problems that deal with concepts currently being covered in the lectures and discussion sections, are designed to encourage regular reading and study of the course material. Each quiz will be worth 20 points. For the 6 quizzes given in the main lecture sections, the lowest score will be dropped, and the remaining 5 scores will be added together to provide a lecture quiz score (out of a maximum of 100 points) for the semester. Similarly, for the 6 quizzes given in the weekly discussion sections, the lowest score will be dropped, and the remaining 5 scores will be added together to provide a discussion quiz score (out of a maximum of 100 points) for the semester. **There will be no make-up quizzes; if you miss a quiz, your score will automatically be zero. Students should keep a continual watch on when quiz scores are posted on the CALM grading system. Any issues concerning the correctness of posted quiz scores must be reported to the instructors of the main lectures within 7 days after the quiz scores are posted; after the 7-day period, no complaints about quiz scores will be allowed.**

## HOMEWORK: COMPUTER ASSISTED LEARNING METHOD (CALM)

We will assign homework problems to be completed with the aid of CALM (Computer Assisted Learning Method), which is an automated, individualized, homework generating–grading program. This tool (CALM) is a Web-based program located at <http://calm.indiana.edu/>. You must be registered in the course to use this tool; **the login and password are the same as those for your email.** Each CALM assignment will be opened on an announced date; as specified by the instructors, you will have only one or two weeks to complete each assignment. At the end of the semester, we will determine the percentage of the total number of CALM problems that you completed successfully; that percentage will represent the total number of points (out of a maximum of 100) that you receive for working CALM problems. Because you can repeat a given CALM assignment until you have achieved perfection, this represents a *sure* opportunity to acquire 100 points.

## DISCUSSION SECTIONS

For each week during the semester, attendance at your discussion section is mandatory. At these discussion sections, the Associate Instructors will administer unannounced quizzes and will give students an opportunity to ask questions, to practice solving problems, and to gain assistance in working CALM

homework problems. By attending each discussion section and by taking unannounced quizzes, each student can earn up to 100 points for the entire semester.

### LECTURE NOTES AND OTHER MATERIALS ON THE WEB

During the semester, lecture notes and other materials (*e.g.*, practice examinations, answer keys for examinations and quizzes) will be made available on the Web. You can access this information by going to <http://courses.chem.indiana.edu/> and by selecting **C117**.

### STUDY HINTS

This is a rigorous and challenging course. Every week you are expected to spend an average of 2 hours outside of class for every hour in class; for this 5-credit class, this translates into 10 study–homework hours outside of class, to go with 8 hours in class, **for a total of 18 hours each week**. Chemistry is based on both conceptual matters and problem solving, and a lot of practice is required to master the subject.

One recommended pattern for studying chemistry is the following:

- (a) **At the very least, skim the text (reading) assignment BEFORE coming to lecture.**
- (b) **Attend lecture and take detailed notes.** Professors' abbreviated lecture notes will be available on the Web. It is the student's responsibility to download these notes before or immediately after the class. Questions on examinations may deal with material from lectures that is not necessarily in the text, so detailed notes are crucial.
- (c) **Study actively.** This takes considerable time to do well, but the effort is rewarding. Studying and learning chemistry is not a passive activity; instead, you should always be doing something while reading the chapters. **Be sure that your own set of study notes is more complete than the notes you take in lecture.** To do this, sit down with your lecture notes and use the text to enhance those notes. Keep in mind that you will want to use these notes to study for examinations. **Work the assigned CALM homework problems in a timely fashion; do not wait until the last minute.** Some examination problems will be similar to CALM problems. In addition, you should work exercises within each chapter of the textbook as well as end-of-chapter problems.
- (d) **Go to discussion sections prepared.** Bring questions about lecture topics, CALM problems, and problems on worksheets.
- (e) **Be sure that you understand the material covered in each lecture before attending the next lecture.**
- (f) **Study on a regular basis.** Do not wait until just a few days before an examination to cram in information. Get help early if you need it.
- (g) **Study for each examination.** Review study notes, and refer to the textbook if necessary. Review problems and take practice examinations under examination conditions (limited time and no use of resources).

### GETTING HELP

If you need help with the reading assignments, the problem sets, or any other aspect of this course, there are several ways to obtain assistance:

- (a) **Faculty Office Hours.** Do not be reluctant to see Professor Baker, Professor Peters, or Professor Stone during the office hours listed earlier. You may also choose to make a special appointment with one of these individuals; see them at the beginning or end of a lecture period, or contact them via email. It is best not to wait until the last minute to seek help.

(b) **Associate Instructor Office Hours.** Each Associate Instructor will have scheduled office hours in the Chemistry Resources Center (Chemistry 046) during which time you can ask questions about the material in the course.

(c) **Discussion Sections.** Make good use of your discussion section by regular attendance and participation; if you need specific help with material from lectures or with problem assignments, the discussion section leaders can provide assistance.

(d) **Special Review Sessions.** Prior to each of the examinations, and at other times if deemed desirable, special review sessions will be held. Announcements of these sessions will be made during lecture periods.

(e) **Tutors.** A list of chemistry tutors will be posted on the Web. You can access the list by going to <http://www.chem.indiana.edu/> and by clicking on **Undergraduate Programs** and then **Tutor List**.

(f) **Free Tutoring.** Beginning with the second week of classes (and including Labor Day), there will be free tutoring for both lecture and laboratory portions of C117 on Sunday, Monday, and Wednesday nights from 6:45 to 9:45 p.m. in the Chemistry Resources Center (Chemistry Room 046).

(g) **Help with Mathematics Needed for Chemistry.** Students seeking extra help with mathematics needed for chemistry might benefit by going to the following website: <http://www.ChemReview.NET>.

## WEEK-BY-WEEK SYLLABUS

Date	Lecture Topic	Reading	Laboratory
<b>Week 1</b> M – Aug 31 T – Sept 1 W – Sept 2 F – Sept 4	Course Introduction Lab Lecture: <i>Introduction to C117</i> Atoms, Ions, Subatomic Particles Isotopes, Atomic Weight, Mole	Chapter 2.1–2.3, 2.5 Chapter 2.6–2.8	<b>LABS DO NOT MEET</b>
<b>Week 2</b> M – Sept 7 T – Sept 8  W – Sept 9 F – Sept 11	Radiation, Quantization, Bohr Atom Lab Lecture: <i>Green Chemistry &amp; Writing Laboratory Reports</i> Quantum Mechanics, Orbitals Electron Configurations	Chapter 7.1–7.3  Chapter 7.4–7.6 Chapter 7.7–7.8	Check in, Safety, and Laboratory Skills
<b>Week 3</b> M – Sept 14 T – Sept 15 W – Sept 16  F – Sept 18	Periodic Properties Lab Lecture: <i>Atomic Spectra</i> Ionic Bonding  Covalent Bonding	Chapter 2.9, 7.9–7.12  Chapter 3.5–3.7, 7.13–7.14 Chapter 3.1–3.4	Green Chemistry & Writing Laboratory Reports
<b>Week 4</b> M – Sept 21 T – Sept 22  W – Sept 23 W – Sept 23 F – Sept 25	Lewis Structures Lab Lecture: <i>Determination of Water Hardness</i> Lewis Structures <b>Exam 1 (covers Weeks 1–3)</b> Bonding Properties	Chapter 8.1–8.3  Chapter 8.4–8.5 Chapter 8.6–8.7	Atomic Spectra for Atoms and Ions
<b>Week 5</b> M – Sept 28 T – Sept 29 W – Sept 30 F – Oct 2	Formal Charge, Resonance Lab Lecture: <i>SPARTAN</i> Resonance, Octet-Rule Exceptions Aromatic Compounds	Chapter 8.8–8.9  Chapter 8.10 Chapter 8.11	Determination of Water Hardness
<b>Week 6</b> M – Oct 5 T – Oct 6 W – Oct 7 F – Oct 9	VSEPR Lab Lecture: <i>% Alcohol in Wine</i> Hybridization Hybridization, Multiple Bonds	Chapter 9.1–9.2  Chapter 9.3 Chapter 9.4	Molecular Modeling Using SPARTAN
<b>Week 7</b> M – Oct 12 T – Oct 13 W – Oct 14 F – Oct 16	Polar Molecules Lab Lecture: <i>Analysis of Milk</i> Polarity, Noncovalent Interactions Weak Interactions in Nature	Chapter 9.5  Chapter 9.5–9.6 Chapter 9.7	Volume % of Alcohol in Wine
<b>Week 8</b> M – Oct 19 T – Oct 20  W – Oct 21 W – Oct 21 F – Oct 23	Energy, Conservation of Energy Lab Lecture: <i>Orthophosphate in Water</i> Heat Capacity, Enthalpy <b>Exam 2 (covers Weeks 4–7)</b> Thermochemistry, Enthalpy Change	Chapter 6.1–6.2  Chapter 6.3–6.4 Chapter 6.5–6.6	Analysis of the Chemical Components of Milk

Date	Lecture Topic	Reading	Laboratory
<b>Week 9</b> M – Oct 26 T – Oct 27 W – Oct 28 F – Oct 30	Bond Energies, Calorimetry Lab Lecture: <i>Hot Pack/Cold Pack</i> Hess's Law, Enthalpy of Formation Energy Dispersal, Entropy	Chapter 6.7–6.8  Chapter 6.9–6.10 Chapter 18.1–18.3	Orthophosphate in Water
<b>Week 10</b> M – Nov 2 T – Nov 3 W – Nov 4 F – Nov 6	Entropy, 2 <sup>nd</sup> Law of Thermodynam. Lab Lecture: <i>Heat Storage</i> Gibbs Free Energy Gibbs Free Energy	Chapter 18.4–18.5  Chapter 18.6–18.7 Chapter 18.8–18.9	Hot Pack / Cold Pack
<b>Week 11</b> M – Nov 9 T – Nov 10 W – Nov 11 W – Nov 11 F – Nov 13	Gibbs Free Energy Lab Lecture: <i>Kinetics</i> Rates of Reactions <b>Exam 3 (covers Weeks 8–10)</b> Rates of Reactions	Chapter 18.10–18.11  Chapter 13.1  Chapter 13.2	Heat Storage for Solar Heating
<b>Week 12</b> M – Nov 16 T – Nov 17 W – Nov 18 F – Nov 20	Rate Laws Lab Lecture: <i>Equilibrium</i> Elementary Reactions, Effect of T Rate Laws, Mechanisms	Chapter 13.3  Chapter 13.4–13.5 Chapter 13.6–13.7	Kinetics of the Iodine Clock Reaction
<b>Week 13</b> M – Nov 23 T – Nov 24 W – Nov 25 F – Nov 27	Catalysis Lab Lecture: <i>NO LAB LECTURE</i> NO CLASS (Thanksgiving Recess) NO CLASS (Thanksgiving Recess)	Chapter 13.8–13.10	<b>LABS DO NOT MEET</b>
<b>Week 14</b> M – Nov 30 T – Dec 1 W – Dec 2 W – Dec 2 F – Dec 4	Equilibrium Constants Lab Lecture: <i>Lab Final Review</i> Equilibrium Constants <b>Exam 4 (covers Weeks 11–13)</b> Equilibrium Constants	Chapter 14.1–14.2  Chapter 14.3  Chapter 14.4	Determination of an Equilibrium Constant
<b>Week 15</b> M – Dec 7 T – Dec 8 W – Dec 9 W – Dec 9 F – Dec 11	Equilibrium Constants Lab Lecture: <i>NO LAB LECTURE</i> Le Châtelier's Principle <b>Lab Final Exam 6:50 – 9:30 p.m.</b> Controlling Equilibria	Chapter 14.5  Chapter 14.6  Chapter 14.7–14.8	<b>LAB FINAL EXAMINATION</b>
<b>Week 16</b> M – Dec 14 T – Dec 15 W – Dec 16	<b>Final Exam, 12:30 – 2:30 p.m.</b> <b>(comprehensive, with extra emphasis on Weeks 14–15)</b>		<b>LABS DO NOT MEET</b>