LECTURES: Lectures for Section 1 are held in Louderman 458. Lectures for Sections 2 and 3 are held in Lab Sciences 300. Section 1 has Professor William Buhro as instructor at 9:00 a.m. Section 2 has Dr. Megan Daschbach as instructor at 10:00 a.m. Section 3 has Professor Richard Loomis as instructor at 11:00 a.m. All sections will cover the same material. There will be no differences in problem sets, quizzes, or exams.

INSTRUCTORS: Professor W. Buhro, Dr. M. Daschbach, Professor R. Loomis, Dr. J. Luo, and Dr. G. Szteinberg

COURSE ADMINISTRATIVE ASSISTANT: Mr. Rick Schneider (Office: McMillen Labs, Room 413) Office Hours: 2:00 pm – 4:00 pm, M-F.

STATEMENT ON DIVERSITY: The Department of Chemistry and all faculty and staff members associated with Chemistry 111A welcome difference in our academic community in the form of gender, race, ethnicity, disability, geography, socioeconomic status, age, politics, religion, philosophy, sexual orientation, gender identity or expression and veteran status. We intend to provide an environment in which persons of different backgrounds and perspectives are all included and may all thrive. We consider diversity among our students, faculty, and staff to provide competitive advantages to universities who strive to honor it.

INNOVATIONS IN GENERAL CHEMISTRY: The Chem 111/112 series is often one of the students’ first opportunities to begin to develop the critical-thinking skills and hone complex problem-solving abilities that are vital to their ongoing scholarly development and success. In Chem 111, we will use a variety of approaches, such as i-Clickers, online homework, recitation, college preparatory material, and supplementary programs, including PLTL, RPM, and peer mentoring. All of these are described in detail below.

TEXT/ONLINE HOMEWORK: Textbook: D. Oxtoby, H. Gillis, and L. Butler, Principles of Modern Chemistry (8th edition). Both the electronic version and print versions of the text are acceptable. Online homework: All students must have access to the OWLv2 online homework platform that is interfaced with Blackboard. NOTE: Problems from earlier versions of the textbook will often be numbered differently. There are four copies of the 8th edition text on reserve in the Chemistry Library.

Note: Integrals and derivatives are used throughout the textbook. However, calculus is NOT a perquisite for this course; therefore, you will NOT be responsible for solving problems using integrals or derivatives.

COURSE WEB SITE: The Chem 111A Web site contains general information, announcements, reading assignments, solutions to assigned problems, quizzes, and exam problems. The Web site is found on the Blackboard Web site (https://bb.wustl.edu) and is also linked through the Chemistry Department courses Web page (http://www.chemistry.wustl.edu/courses/fall-2016/general-chemistry-i).

COURSE CALENDAR: http://www.chemistry.wustl.edu/~courses/calendars/chem111_cal.html The course calendar may also be found under the Calendar tab in Chem111A Blackboard Web site.

COURSE MESSAGES or EMAIL: Students may communicate with course instructors after class, by course e-mail (genchem@wustl.edu) or by speaking to Mr. Schneider (McMillen Labs 413). Students are requested not to phone or e-mail the instructors directly.
i-CLICKERS: This semester, all three sections of Chem 111 will be using i-Clicker technology during every class. While no course credit will be awarded for i-Clicker participation, each student is encouraged to participate on a daily basis. Studies have shown that active learning improves student performance in science courses. Each student will need to check out an i-Clicker from Olin Library in order to participate. This device is free to each student registered in the course, so be prepared to present your student ID at the Olin library reference desk. Return your i-Clicker after classes end and before December 21. Students who do not return their i-Clicker at the conclusion of the semester will be charged for the replacement of the device.

CALCULATORS: For Chemistry 111A and 112A offered in the 2016-2017 academic year, only the following models of electronic calculator will be allowed during quizzes and exams:

The **preferred models** for ease of calculation are the following **4-line** calculators:
- TI-30 XS Multiview
- TI-34 Multiview

The following **2-line** calculators are also acceptable:
- TI-30Xa
- TI-30X IIs (solar)
- TI-36X

PLEASE NOTE: The TI-30XS-PRO and the TI-36X-PRO are **NOT** allowed.

No exceptions will be granted and this policy will be strictly enforced. These are all four- or two-line, non-programmable, non-graphing calculators. They are available from the WU bookstore, and also from (among other places) Amazon, Walgreens, and Office Depot. **Please note: your calculator must be approved by your TA during the first Recitation session on September 8 before you take the first quiz on September 15.**

RECITATION CLASSES: Recitation Classes (Subsections A–Z, XX, YY, and ZZ) will be held weekly on Thursdays, beginning September 8. Standard one-hour recitations are held at 9:00 a.m., noon, and 3:00 p.m. Extended and POGIL recitations are held at 8:30 a.m., 11:30 a.m., and 2:30 p.m. You must register for and attend the **SAME** Recitation Class the entire semester. These classes will discuss lecture material and additional illustrative problems. Nine quizzes, one per week, will be given beginning on Thursday, September 15, except for the weeks of midterm exams and Thanksgiving. **There are no make-up quizzes.** A score for each student will be generated based on the student’s top seven quiz grades. In calculating the total quiz score, the lowest two scores will be dropped and remaining total will be used.

PROBLEM SETS: Problem sets will usually be assigned on Friday. All assigned problems, either from the textbook or additional non-textbook problems, will be posted under the **Problem Set Assignment Folder.**

Some problems will be required to be submitted online, for course credit, via the OWLv2 Program. Links to these problems can be found in the **Graded Homework** Folders. There are 13 problem sets throughout the semester. Each graded problem set is worth a total of 3 points. Your best 10 scores will be kept, totaling 30 possible points, for submitted and correct homework problems. Immediate feedback about the correctness of all submitted answers online is available directly through the OWLv2 system. Solutions to the graded homework sets will not be posted on Blackboard. Note: Creators of the OWLv2 program suggest using either Firefox or Chrome as a web browser when using the program.

Three of the homework assignments (problem sets 2, 8 and 13) will include a short reading/writing assignment in addition to the regularly-assigned, graded online homework. These three homework assignments (2, 8 and 13) will still be worth 3 points in total, with the reading/writing assignment worth 1/3
points and the graded online homework (submitted via OWLv2) worth 2/3 points. These reading/writing assignments will not be related directly to chemistry, but they will cover information that we believe will be useful as you navigate this course and your college career more generally.

Other problems will be assigned, but do not require a formal submission and will not be graded. These problems will include both textbook problems and non-textbook problems. The non-textbook problems have been written by the instructors of Chem 111 and students find these are beneficial as they often resemble questions posed in quizzes and exams. Therefore, all problem (both graded and non-graded) are important when preparing for upcoming quizzes and exams. Non-graded homework assignments may be found in the Non-graded Homework Folders. There are 13 non-graded problem sets throughout the semester. Solutions to these non-graded homework sets may be found in the Problem Set Solutions Folder, which will be posted one week after each set is assigned.

Both the Graded Homework and Non-graded Homework folders are found in the Homework Section of the Blackboard Chem 111 course web site.

OWLv2 TECHNICAL SUPPORT: Students experiencing any technical difficulties with either the e-text or the online homework should find the OWLv2 Technical support section of the Blackboard Chem 111 course web site. Here, students will find the information regarding phone support (dial 1-800-354-9706) as well as a link to the Cengage customer support website, with options to either online chat with a support technician or to submit a claim ticket, for non-urgent requests.

ACCESS TO SUPPLEMENTARY PROBLEMS: Problems from the weekly Peer-Led Team Learning (PLTL) study-group sessions will be posted on the Monday morning following a PLTL session. PLTL Study Problems will be posted under the PLTL Problems Folder in the Files Section of the Blackboard Chem 111 course web site. Solutions to these problems are not posted. Questions about these problems may be asked at help sessions. Problems from the weekly POGIL recitations will be posted on the Friday morning following each Recitation session. POGIL recitation problems will be posted under the POGIL Recitation Problems Folder in the Files Section of the Blackboard Chem 111 course web site. Solutions to these problems are not posted. Questions about these problems may be asked at help sessions.

EXAMS: Three (3) one-and-a-half hour (1.5 hr) exams will be given on Tuesdays on the following dates and times this semester: Tuesday, October 4, 7:30 p.m. – 9 p.m.; Tuesday, November 1, 6:30 p.m. – 8 p.m.; and Tuesday, December 6, 6:30 p.m. – 8 p.m. All exams are closed book and notes, and will consist of problems and questions. No electronic devices of any nature except the approved calculators are allowed. Each exam will be worth 100 points with a mean that is anticipated to be between 60 and 65 points. In the event that a mean lower than this range is obtained, the instructors reserve the right to adjust the exam scores to higher values. The grade cutoffs included in the table below can be used to provide self-evaluation for students on each exam. (Cutoffs for “plus” and “minus” letter grades will only be assigned for the final course letter grades, not for each exam.) Exam rooms will be announced during lecture, and will be posted under the Announcements Section of the Blackboard Chem 111 course web site.

Graded exams will be returned under supervision on presentation of a valid student ID on the Monday following each exam in the Resource Room on the 4th floor of the Lab Sciences building from 1:30 – 3:00 p.m. Any exams not picked up during that time may be retrieved directly from Mr. Rick Schneider in McMillen Labs Room 413 (on presentation of a valid student ID) during his office hours (2:00 pm – 4:00 pm, M-F). There are no make-up exams.

A student’s two highest exam scores (2 out of the 3 midterm exams) will be considered in determining final point totals for the course. THERE ARE NO MAKE-UP EXAMS. If an exam is missed, this will be
considered the low score to be discarded. This is to take into account possible absences due to illness or other unavoidable circumstances.

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Midterm Exam Points</th>
<th>Final Exam Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>≥ 75</td>
<td>≥ 97</td>
</tr>
<tr>
<td>B</td>
<td>55 – 74</td>
<td>72 – 96</td>
</tr>
<tr>
<td>C or lower</td>
<td>&lt; 55</td>
<td>&lt; 72</td>
</tr>
</tbody>
</table>

**FINAL:** A 130-point cumulative final exam will be given on **Tuesday, December 20**, from **8:00 to 10:00 a.m.** The final exam is **mandatory** for obtaining a passing grade in the course.

**EXAM REGRADES:** To submit a regrade request, students must execute the following procedure. A properly completed **regrade request form** must be **stapled** to the **first page** of the exam listing a **brief** explanation of each grading error. The entire exam must be turned in. **NOTHING ON THE EXAM PAGES MAY BE CHANGED.** If additions or changes to the graded exam are made, the regrade request will be invalidated and disciplinary action will be taken (see Ethics section below). Regrade requests will be handled by the instructors. The regrade points ultimately awarded will then depend on the validity of the regrade request as determined by the instructors. Students will earn **black marks** for illegitimate regrade requests commensurate with the number of such requests. These black marks may be considered negatively in assigning semester grades to borderline cases. A handout entitled **Guidelines for Legitimate Chem111A Regrade Requests** will be available after the first exam to help students identify and prepare legitimate requests. This handout can be obtained under the **Course Handouts** Folder in the **Files** Section of the **Blackboard Chem111 course Web site.** All students should examine the handout before submitting regrade requests.

Requests for corrections of simple clerical errors or incorrect addition of exam total scores will not be considered to be regrade requests, and such corrections will be made at any time throughout the Fall semester and winter break until **January 20, 2017**, with no risk of earning black marks.

Regrade requests must be turned in by **4:00 p.m.** on the **Friday** after the midterm exam is returned to you. Return the regrade request to the wooden cabinet, labeled "**Chem 111/112 Regrade Requests,**" on the **2nd floor of Lab Sciences.** Regrade requests for the final exam must be turned in by **4:00 p.m.** on **Friday, January 20, 2017.**

**Please note: absolutely no regrade requests will be considered after the regrade deadlines listed here.**

To ensure fair and equal treatment of all students, changes in exam scores will be made only through this formal, written regrade mechanism. The instructors will not discuss or make changes to exam scores in face-to-face meetings with students. Once an instructor has regraded an exam, that score is final.

**STUDENT SCORES:** Quiz and Exam scores can be checked through the **Tools Section under My Grades** on the **Blackboard Chem111 course Web site.**

**GRADES:** Each student’s point total will be the sum of the two highest 1.5-hour mid-term exam scores, the final-exam score, the overall homework score (which is a maximum of 30 points), and the overall quiz score
(which is a maximum of 70 points). Thus, there will be a maximum of 430 total points. (Students are urged to keep their quizzes and exams as a safeguard against bookkeeping errors.) Letter grades will be assigned on the basis of a direct comparison of the point totals to the sum of the grade cutoffs. The instructors reserve the right to adjust the letter-grade cutoffs to lower total-point values, but cutoff-point values will not be raised. For students opting to take the course Credit/No Credit, a Credit will require a letter-grade equivalent of a C– or above.

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Total Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>≥ 336</td>
</tr>
<tr>
<td>B</td>
<td>256 – 335</td>
</tr>
<tr>
<td>C or lower</td>
<td>≤ 255</td>
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</tbody>
</table>

GUIDELINES AND EXPECTATIONS FOR ANSWERING QUESTIONS ON QUIZZES AND EXAMS: One of the goals of this introductory science course is to train students to think, conclude, and communicate like scientists. Good communication in science occurs through (among others) graphs, plots, schematics, and written word. As the semester in General Chemistry progresses, the instructors will become more critical of how students communicate via responses on quizzes and exams. Graphs and plots need to be neat, accurate, and clearly labeled. Schematics (and pictures) need to be neat and clearly communicate the phenomena they are intended to represent. Written communication (i.e. justifications) needs to be well-written (in complete sentences), fully introduce an idea or concept, develop that idea or concept, and clearly lead to a well-defined conclusion.

GENERAL HELP SESSIONS: These sessions provide opportunities for students to interact with the instructors in an informal setting and work problems. Many students find these to be extremely helpful when preparing for weekly quizzes or exams. The instructors recommend that students participate in one help session per week. General Help Sessions are open to all students in Chem 111A and will be held beginning Friday, September 9. Students may attend any help session regardless of the section in which they are registered.

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Room</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>3:00 pm – 4:30 pm</td>
<td>TBD</td>
<td>Luo</td>
</tr>
<tr>
<td>Tuesday</td>
<td>3:00 pm – 4:30 pm</td>
<td>TBD</td>
<td>Loomis</td>
</tr>
<tr>
<td>Wednesday</td>
<td>3:00 pm – 5:00 pm</td>
<td>TBD</td>
<td>Daschbach</td>
</tr>
<tr>
<td>Friday</td>
<td>3:00 pm – 4:30 pm</td>
<td>TBD</td>
<td>Buhro</td>
</tr>
</tbody>
</table>

COURSE-CONTENT VIDEOS: Short, instructional, course-content videos have been prerecorded for you this semester. These are available in the Course Content Videos Section of the Blackboard Chem 111 course web site. These videos are meant to either introduce a particular topic or provide more detailed examples that will expand upon material already presented in lecture. In the class immediately following an assigned video, there will usually be a segment in which the key ideas and concepts from these videos will be reviewed through a series of i>Clicker questions. We will then build on the ideas presented in the videos throughout the lecture, but we will not directly cover the same material in class.

LECTURE VIDEOS: Video of all lectures will be posted in the Blackboard pages for this course. To access the videos, click on ‘Lecture Videos’ in the Blackboard course menu. Under this tab, the uploaded taped lectures will be organized by section/instructor. Click on the lecture section you wish to view and then find the video you would like to watch (videos are organized by date). To view the video in "full screen" mode, click the blue link below the thumbnail. The video will open in a new tab of your browser. Videos will
appear on Blackboard within 24 hours of their recording. If you have problems accessing the videos, please contact Student Technology Services by submitting a trouble ticket at sts.wustl.edu, or stopping by the STS Help Desk in Gregg Hall on the South 40. Please remember that the availability of the videos is dependent on the availability of Blackboard. Blackboard is unavailable every Friday from 3:00 a.m. to 5:00 a.m. for scheduled maintenance.

LECTURE NOTES: TAs will take lecture notes. Students may request a copy of these notes via email to the course email at genchem@wustl.edu (please note: the email must be sent from your @wustl.edu account and must include your full name and student ID number).

PLTL STUDY GROUPS: There are optional PLTL study groups that meet once a week on Saturday or Sunday for a two-hour workshop. Each study group works together on prepared problems that are designed to be solved cooperatively, with a PLTL undergraduate leader facilitating the group. The groups utilize collaborative-learning strategies in their sessions. The leader does not help solve the problems, but guides and facilitates the group.

Online sign-up for PLTL begins at 5:00 p.m. on Monday, August 29. The link to the online application may be found after 5:00 pm on August 29 under the Links Section of the Blackboard Chem 111 course web site.

The deadline for signing up is 1 p.m. on Friday, September 2. First-year students must have taken the online diagnostic exam by Midnight on Monday, September 5 to be placed in a group. Please note: you may register for PLTL before completing the online diagnostic exam as long as the deadline is met. Group information will be sent to your Washington University e-mail address by Friday, September 9. The first PLTL sessions will be on Saturday, September 10 or Sunday, September 11. Please note: the online application for PLTL includes an attendance policy. If you sign-up for a PLTL group, you must attend all PLTL sessions.

RESIDENTIAL PEER MENTORS: Residential Peer Mentors (RPMs) are trained upperclassmen who received an A in the course for which they provide mentoring. These mentors meet weekly with the General Chemistry instructors to prepare for their sessions. Each freshmen residential college has a dedicated Chemistry RPM living in residence with scheduled office hours. No appointment is necessary.

ACADEMIC MENTORS: Academic mentors are available for group workshops. Students should go to Cornerstone: Center for Advanced Learning (located in Gregg Hall on the South 40) to join a group. Additional information can be obtained from the Cornerstone Web site (http://cornerstone.wustl.edu).

DISABILITY SERVICES: Students who are seeking disability information or support for a disability should contact Disability Resources (DRC) at 935-5970. Disability Resources is located at Cornerstone in Gregg Hall on the South 40. Disability Resources is responsible for approving and arranging all accommodations for University students.

ETHICS: Evidence of an academic integrity violation or attempted academic integrity violation will be forwarded to the Committee for Student Academic Integrity, and we will follow the committee’s recommendations. Please refer to the “Statement of Student Academic Integrity” on the Washington University Web site at: http://studentconduct.wustl.edu/academic-integrity/policies-and-procedures/

Please note: all graded quizzes and exams are scanned and filed prior to returning to students.
ACCOMMODATIONS BASED UPON SEXUAL ASSAULT: The University is committed to offering reasonable academic accommodations to students who are victims of sexual assault. Students are eligible for accommodation regardless of whether they seek criminal or disciplinary action. Depending on the specific nature of the allegation, such measures may include but are not limited to: implementation of a no-contact order, course/classroom assignment changes, and other academic support services and accommodations. If you need to request such accommodations, please direct your request to Kim Webb (kim_webb@wustl.edu), Director of the Relationship and Sexual Violence Prevention Center. Ms. Webb is a confidential resource; however, requests for accommodations will be shared with the appropriate University administration and faculty. The University will maintain as confidential any accommodations or protective measures provided to an individual student so long as it does not impair the ability to provide such measures.

If a student comes to one of the General Chemistry instructors to discuss or disclose an instance of sexual assault, sex discrimination, sexual harassment, dating violence, domestic violence or stalking, or if we otherwise observe or become aware of such an allegation, we will keep the information as private as we can, but as faculty members of Washington University, we are required to immediately report it to our Department Chair or Dean or directly to Ms. Jessica Kennedy, the University’s Title IX Coordinator. If you would like to speak with the Title IX Coordinator directly, Ms. Kennedy can be reached at (314) 935-3118, jw kennedy@wustl.edu, or by visiting her office in the Women’s Building. Additionally, you can report incidents or complaints to Tamara King, Associate Dean for Students and Director of Student Conduct, or by contacting WUPD at (314) 935-5555 or your local law enforcement agency.

You can also speak confidentially and learn more about available resources at the Relationship and Sexual Violence Prevention Center by calling (314) 935-8761 or visiting the 4th floor of Seigle Hall.

Bias Reporting: The University has a process through which students, faculty, staff and community members who have experienced or witnessed incidents of bias, prejudice, harassment or discrimination against a student can report their experiences to the University’s Bias Report and Support System (BRSS) team. See: brss.wustl.edu

Mental Health: Mental Health Services’ professional staff members work with students to resolve personal and interpersonal difficulties, many of which can affect the academic experience. These include conflicts with or worry about friends or family, concerns about eating or drinking patterns, and feelings of anxiety and depression. See: shs.wustl.edu/MentalHealth

DISCLAIMER: The instructors reserve the right to make modifications to this information throughout the semester.

1. **Quantum Mechanics and Atomic Structure**
   A. Structure of the Atom (Sect. 1.3 – 1.4)
   B. Waves and Light (Sect. 4.1)
   C. Bohr Atom, Photoelectric Effect, and Atomic Spectra (Sect. 4.2 – 4.4)
   D. Wave-Particle Duality (Sect. 4.4)
   E. The Schrödinger Equation and Particle-in-a-box Model (Sect. 4.5 – 4.7)
   F. Quantum Mechanics of the Hydrogen Atom (Sect. 5.1)

2. **Multi-electron Atoms and Periodicity**
   A. Atomic Configuration (Sect. 5.1 – 5.3)
   B. Periodic Trends including Bond Types: Ionic, Covalent, and Polar Covalent (Sect. 3.6, 3.9 and 5.5)

3. **Chemical Bonding**
   A. Lewis Structures (Sect. 3.10)
   B. VSEPR Model (Sect. 3.11)
   C. Hybridization (Sect. 6.9 – 6.10)
   D. Molecular Orbital Theory (Sect. 6.3 – 6.6)
   E. Combining Hybridization and Molecular Orbital Theory (Sect. 7.4)

4. **Properties of Gases, Intermolecular Forces**
   A. Ideal Gases (Sect. 9.1 – 9.5)
   B. Real Gases (Sect. 9.6)
   C. Intermolecular Forces and Dipole Moments (Sect. 10.2 – 10.3)