Time and location:
Section 1: MWF 11:15 AM – 12:05 PM – BRUININKS HALL 230
Section 2: MWF 2:30 – 3:20 PM – SMITH HALL 100

Instructor: Prof. Valerie C. Pierre
237 Smith Hall
pierre@umn.edu
(612) 625-0921

Instructor office hours:
Wednesdays 3:30 – 5:00 pm and Fridays 12:30 – 2:00 pm in Smith 237; other times by appointment only and only if you cannot come to these office hours.

Course description: Chemistry 1061 and 1062 are introductory lecture courses (each 3 credits), accompanied by a separate lab course (Chem 1065, 1066, each 1 credit). These courses are designed to help prepare students for science and engineering majors, including chemistry. Each lecture/lab pair fulfills the Diversified Core requirement in Physical Science. Why is this course considered an important component of my liberal education? A liberally educated person is one who can understand complex issues, find credible information, analyze that information, problem-solve, and draw reasonable conclusions based on facts. These courses will help to develop the skills of an informed citizen and life-long learner.

Prerequisite: To register/remain registered in 1062, you must fulfill 2 criteria:

- You must have passed Chem 1061 or an equivalent course with a grade of C- or better. This course also makes use of math skills in the areas of logarithms, scientific notation, graphing, and algebra.
- You must also be registered in the lab, Chem 1066 this semester.

If you do not meet these requirements, you should report your situation to the staff in Smith 115 (624-0026) immediately. They handle all registration issues pertaining to this course. They must also be informed if you are retaking this course without the lab (having passed it previously).

Supplies: (All are available in the U of M Bookstore in Coffman Union.)
Required:

- Access to an internet-capable laptop or desktop computer with webcam and microphone to access our exam system for midterms (chapter exams) and the final exam.
- Mirror (around 6 x 6”) and portable whiteboard (around 10 x 12”) for use in our e-proctoring system (details in Canvas)
- Note that the publisher’s online homework system (ALEKS) is required and provided for free in the textbook package at the bookstore.
- Non-programmable scientific calculator (see details below)
**Student Learning Outcomes**
- Identify, define, and solve problems
- Master a body of knowledge and mode of inquiry
- Acquire skills for effective citizenship and life-long learning

A new text purchased at the U of M Bookstore is packaged with access to the ALEKS online learning system for 2 semesters. The 180 day access to ALEKS does come with access (during that time) to the e-book version of Silberberg and Amateis as well. You will need either a print copy of the book or access to the e-book for the duration of the semester. You will also need access to ALEKS for the duration of the semester.

**Attendance:** Attendance is important! YOU ARE RESPONSIBLE for all announcements and for all material covered in class, whether or not the topic is in the text. Also, it is YOUR RESPONSIBILITY to obtain missed lecture notes and announcements regarding changes in this syllabus.

**Registration:** All course registration matters are handled through the General Chemistry Office in 115 Smith Hall (612-624-0026).

**Course website:** Students registered in this course must use the CHEM 1062 Canvas site and the ALEKS online learning system.

1. **Lecture Canvas Site**
   CHEM 1062 Chemical Principles II (sec 01 and 02) Fall 2019
   This site includes various resources to help you succeed in this class:
   - This syllabus
   - List of learning objectives per chapter
   - Pdf’s of the slides used in class
   The lecture slides include figures and problems that we will go over in class. **They are NOT a complete set of lecture notes.**
   - Homeworks #1-7, broken down by "Topic", including reading and problems
   - Your exam grades

   **Accessing Canvas:** Go to https://canvas.umn.edu/ and select the link for the appropriate class.

2. **ALEKS online learning system** - see description below.

Additionally, these websites will be useful to you:

3. **Lab Canvas Site**
   CHEM 1066 Chemical Principles II Laboratory Fall 2019. This is where you will find your lab syllabus for Chem 1066 and multiple resources associated with completion of the laboratory projects. You will view your LAB grades here. Note that the lab is a separately graded course that must be taken during the same semester that you take Chem 1062.

4. **General Chemistry Program Information**
   [http://genchem.chem.umn.edu/](http://genchem.chem.umn.edu/) and
   [http://genchem.chem.umn.edu/chem-10621066/tutor-room-schedule](http://genchem.chem.umn.edu/chem-10621066/tutor-room-schedule) has general information about 1062 and 1066 (syllabus, lab sections, tutor hours, etc.).
**Homework and Problem Sets**

**Homework (not for credit)**
- Homeworks Chp16 through Chp23 on our Canvas site provide recommendations for readings in the text and associated end-of-chapter problems. Doing these problems is very useful to help learn the material and prepare for exams. All of the topics covered on our exams are also included in these Homeworks. • Answers to assigned problems with black numbers are posted on Canvas. Answers to problems with red numbers are listed in Appendix E of the text.

**Online Learning (ALEKS) – for credit**
ALEKS stands for Assessment and LEarning in Knowledge Spaces. It is a Web-based, artificially intelligent assessment and learning system. ALEKS uses adaptive questioning to quickly and accurately determine exactly what a student knows and doesn't know in a course. ALEKS then instructs the student on the topics she is most ready to learn. As a student works through a course, ALEKS periodically reassesses the student to ensure that topics learned are also retained. ALEKS courses are very complete in their topic coverage and ALEKS avoids multiple-choice questions. ALEKS also provides the advantages of one-on-one instruction, 24/7, from virtually any Web-based computer for a fraction of the cost of a human tutor.

**A prerequisite review objective is due on 09/07/19:** It will not count toward your grade but will establish that you have the prerequisite knowledge needed for you to succeed in this class. If you have difficulties finishing this prerequisite objective, it is highly recommended that you talk to the instructor before the first exam. Seven objectives ("problem sets") are available for our class on ALEKS and will count toward your ALEKS grade. These are due at 11:59 PM on the Saturday before each exam.

<table>
<thead>
<tr>
<th>ALEKS objective</th>
<th>chapter covered</th>
<th>due date at 11:59 PM</th>
<th># ALEKS points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective 1</td>
<td>chapter 16</td>
<td>09/14/2019</td>
<td>10</td>
</tr>
<tr>
<td>Objective 2</td>
<td>chapter 17</td>
<td>09/28/2019</td>
<td>10</td>
</tr>
<tr>
<td>Objective 3</td>
<td>chapter 18</td>
<td>10/12/2019</td>
<td>10</td>
</tr>
<tr>
<td>Objective 4</td>
<td>chapter 19</td>
<td>10/26/2019</td>
<td>10</td>
</tr>
<tr>
<td>Objective 5</td>
<td>chapter 20</td>
<td>11/09/2019</td>
<td>10</td>
</tr>
<tr>
<td>Objective 6</td>
<td>chapter 21</td>
<td>11/23/2019</td>
<td>10</td>
</tr>
<tr>
<td>Objective 7</td>
<td>chapter 23</td>
<td>12/14/2019</td>
<td>10</td>
</tr>
<tr>
<td>Pie</td>
<td>all chapters</td>
<td>12/15/2019</td>
<td>30</td>
</tr>
</tbody>
</table>

There are also seven "post-objective progress assessments" scheduled after each objective is done. These do not affect your objective grades but will affect your pie mastery. **The final pie mastery is due on 12/15/2019 at 11:59 PM.**

In our class, ALEKS **will** count toward your grade. A maximum of 100 points can be earned from ALEKS. The number of ALEKS points will be calculated from your ALEKS grade:

**Accessing ALEKS:**
1. go to www.aleks.com
2. Click on SIGN UP NOW!
3. Enter our class code: **G3QPV-9D3WA** (This is a unique code for our class.)
4. Check that you're in the right class (Chem 1062, Fall 2019 section 1/2, Valerie Pierre)
5. You will now be prompted to enter your access code. It is on this page you can purchase access with a credit card.
6. Fill out student information. Enter your U of M email address in both the email AND "Student ID" field. YOU MUST DO THIS TO GET CREDIT.

7. Take the Initial Assessment (due September 7th, 2019)

• You will be asked to solve about 20-30 problems (this will take you anywhere from 30 to 90 minutes – at any time you can logout and log back on, it will keep your place).
• You'll get no help at all, nor should you try to find any. The idea is to find out where you should start learning, and you want ALEKS to get that just right. If you get your friend the chem grad student to help you, or do a lot of googling, you'll just end up with learning that is way too hard and frustrating, because you'll be missing important pre-requisites. If you don't take the assessment seriously, you'll just end up wasting time on material you already know.
• The assessment is over the entire first-year material, so you can expect to get problems you have no idea how to solve. Don't worry about that. This is a placement test, not a final exam. Your score on the initial assessment does not count toward your ALEKS grade and there's no reward for doing better or penalty for doing worse. This assessment includes material from later in the semester. However, if you research the questions before answering them, ALEKS might later ask you questions that are too hard, because it will skip questions on useful prerequisite topics. On the other hand, if you hurry through the initial assessment and incorrectly answer questions on material that you do know, ALEKS may ask too many questions later that are too easy for you. Take the time to answer each question. ALEKS is not a race. How much time you take to answer questions is not taken into account in your grade.

8. Prerequisite objective
• Take the Prerequisite Review Objective. This objective is due on due September 7th, 2019. The goal of this objective is for you to review and to ensure that you have mastered the material covered in Chemical Principles I (CHEM 1061) that you will need to succeed in this class. A total of 76 topics are included in this objective. If you have difficulty completing this objective and mastering all 76 topics, please see the instructor, Prof. Pierre, as soon as possible.

9. Learning Mode
• After the assessment, you will see your ALEKS “pie.” This shows you what you already know, what you’re ready to learn, and what topics you’ll eventually need to learn, and by what dates.
• You can begin working on topics by scrolling over your pie slices, available topics will be hyperlinked and you can begin!
• The goal is to fill the pie. If you complete an "objective" (problem set) before its due date, you go into "open pie" mode and can work on questions in earlier or later objectives. The pie had 219 topics.

Your ALEKS grade
* Intermediate Objectives: 70% of ALEKS grade (10%/objective)
You'll be expected to reach certain "mileposts" in your mastery of the entire curriculum at certain dates. ALEKS will keep track of this. The purpose of this is, frankly, to keep you working regularly. Check the Gradebook for your score on this metric. There are four objectives in your class (see dates above). The Prerequisite Review Objective does not count toward your grade.

* Final mastery: 30% of ALEKS grade
The remainder of your grade will be determined just by your overall level of mastery at the end of the class -- how many topics ALEKS says you've mastered. The purpose of this is, first, to give you credit for mastery whenever it is achieved, even if it’s achieved well after the initial deadline. It is also to give you a strong motive for restoring topics to your mastery list that you may lose on re-assessment. We don't want you forgetting what you learned in Week 1 by the
time you get to Week 8. That would result in a sad experience on the final exam. Look at the numerator on the fraction above the ALEKS pie for your score here.

Technical issues with accessing ALEKS
The FASTEST way to get questions about ALEKS answered is to contact tech support at ALEKS. They are very helpful, accessible and prompt! Available: Sunday, 4:00 PM to 1:00 AM (Eastern); Monday - Thursday, 7:00 AM to 1:00 AM (Eastern); Friday, 7:00 AM to 9:00 PM (Eastern). Phone: (714) 619-7090 Email: contact us at http://support.aleks.com

EXAMS:
The Chem 1062 chapter exams will be given electronically at 5:00 AM – 10:00 PM on:

- **Exam 1** Chapter 16 Monday, September 16th, 2019
- **Exam 2** Chapter 17 Monday, September 30th, 2019
- **Exam 3** Chapter 18 Monday, October 14th, 2019
- **Exam 4** Chapter 19 Monday, October 28th, 2019
- **Exam 5** Chapter 20 Monday, November 11th, 2019
- **Exam 6** Chapter 21 Monday, November 25th, 2019

The **FINAL EXAM** will be:
- **Section 01:** Thursday, December 19th, 2019, 1:30 – 3:30 PM
- **Section 02:** Monday, December 16th, 2019, 1:30-3:30 PM

No early or late final exams will be given. No extra time will be granted, exams must be completed by 10 pm, so START ON TIME!

ALL exams are closed book and closed notes; only non-graphing calculators are allowed (see below: calculator policy.) The equation sheet and periodic table at the end of this syllabus will be provided electronically with every exam.

**Exam Content:** Exams will cover all the material discussed in class, all assigned reading, and problems in the homeworks. Exams are not limited to questions from ALEKS. The final exam is comprehensive and contains all the material covered in CHEM 1062.

**Exam Format:** You must have your student I.D., whiteboard, calculator, and mirror at each of the chapter and final exams. I.D. checks will be made by the e-proctoring system. All chapter exams for this course of 12-20 questions, including multiple-choice, short answers, ranking, and matching. The exams will be proctored and graded by computer. Make sure you understand fully how to set up your computer and prepare for e-proctoring in advance of the actual exams. Details are provided in the class Canvas site.

**Calculator Policy:** A policy in all of the general chemistry courses is that programmable or graphing calculators may not be used during exams. The presence or use of an unacceptable calculator during an exam will be considered to be scholastic dishonesty.

The recommended model is the **TI-30Xa** (one-line display), which is available at the U of M Bookstore in Coffman Union. Another acceptable model is the two-line display **TI-30XIIS**. (Many other two-line calculators are also programmable so would not be acceptable.) If you have a different **non-programmable, non-graphing** calculator that you’d like to use during
exams, please show it to the instructor at least 1 week before the exam so that it may be added it to a list for the proctors of acceptable models. It is useful for the calculator to be able to display numbers in scientific notation (e.g., 6.02x10^{23}) and to have exponential and logarithmic functions, including natural logs (base $e$).

Calculators may not be shared among students during exams.

Cell phones or other electronic communication devices must be turned off and may not be used during the exams. Presence or use of a cell phone or other unacceptable electronic devices during an exam will be considered to be scholastic dishonesty. Presence or use of notes or books during an exam will also be considered to be scholastic dishonesty.

**Alternative exam times:** There are no alternative exam times.

**Missed Exams:** In the case of a true emergency, serious illness, or University-related trip that prevents a student from taking a chapter exam, an excused absence may be granted in strict accordance with University policy (see link below). To obtain an excused absence, students must contact the instructor at least two weeks in advance of the trip or, in case of illness or death in the immediate family, within 24 hours after the exam to discuss the nature of the emergency. Documentation will be required. Missing an exam due to illness must be verified by a doctor’s note. A confirmation of contact from Boynton is not considered an acceptable excuse. Missing an exam for any other reason will not be excused. If a midterm exam is missed due to extraordinary circumstances (e.g. hospitalization), and supporting documentation is provided, the missed exam score will be replaced by the unweighted average score of all other chapter exams and of the final exam in the course. No make-up exams will be given. An unexcused absence from any of the chapter exams will result in a score of zero for that exam. If circumstances lead to a student missing more than one chapter exam, the student must immediately schedule a meeting with the instructor to discuss any available options. For information on missing the final exam, see “Incompletes”. An unexcused absence from the final exam will result in a final grade of “F” (fail) for the class.

http://www.policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html

**COURSE GRADES:**

**A-F Grade:** Your scores on the chapter exams, the final exam, and ALEKS will be combined as follows to determine the overall grade in the course:

**Grading:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter exams</td>
<td>300 points (6 × 50 points)</td>
</tr>
<tr>
<td>Final</td>
<td>200 points</td>
</tr>
<tr>
<td>ALEKS</td>
<td>100 points</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>600 points</strong></td>
</tr>
</tbody>
</table>

Course % average = total points / 6

Letter grades for exams will be determined entirely by your course % average as follows. Those are absolute grade cut-offs. There will be no “curve” applied to this course.
### Class Average Required for Letter Grades

<table>
<thead>
<tr>
<th>Course % average</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong> 85</td>
<td>(510 points)</td>
<td></td>
</tr>
<tr>
<td><strong>A-</strong> 80</td>
<td>(480 points)</td>
<td></td>
</tr>
<tr>
<td><strong>B+</strong> 75</td>
<td>(450 points)</td>
<td></td>
</tr>
<tr>
<td><strong>B</strong> 70</td>
<td>(420 points)</td>
<td></td>
</tr>
<tr>
<td><strong>B-</strong> 65</td>
<td>(390 points)</td>
<td></td>
</tr>
<tr>
<td><strong>C+</strong> 60</td>
<td>(360 points)</td>
<td></td>
</tr>
<tr>
<td><strong>C</strong> 55</td>
<td>(330 points)</td>
<td></td>
</tr>
<tr>
<td><strong>C-</strong> 50</td>
<td>(300 points)</td>
<td></td>
</tr>
<tr>
<td><strong>D</strong> 40</td>
<td>(240 points)</td>
<td></td>
</tr>
</tbody>
</table>

**S/N Grading:** For students in a college other than CSE and CBS who might register for this course on an S/N basis, a grade equivalent to "C-" on the A-F scale will be required to receive an "S". A grade of D+ or below will receive an "N". Students taking this grading option are encouraged to first check its appropriateness with their program.

**Incompletes:** A student who is otherwise doing satisfactory work and has completed the lab requirements but must miss the final exam for a valid reason can obtain a course grade of I (incomplete). Arrangements must be made before the final, and provisions for making it up will be arranged on a case-by-case basis. A signed contract is required. This option is rarely exercised. An unexcused absence from the final exam will result in a final grade of “F” (fail) for the class.

**Withdrawals:** We hope that every student will successfully complete this course. If, however, it becomes necessary to drop the course you must officially withdraw from the course following the rules for your college. Students who withdraw will not have any records retained for use upon retaking the class. As noted on the class schedule, "Students who drop CHEM 1062 (lecture) before November 1st, 2019 are REQUIRED to drop CHEM 1066 (lab). No Exceptions!"

**Retaking the Course:** Students who have completed the lab (Chem 1066) and wish to retake Chem 1062 should speak with the staff in Smith 115.

**Getting Help**
All of us in the Chemistry Department want you to succeed in this course. In addition to attending lecture and laboratory periods, you can take advantage of the assistance offered in office hours, the tutorial room, and exam review sessions. It is a good idea to get help early to deal with potential problems before they escalate.

Aside from the instructor’s office hours (see first page), the following are available to you:

**TA Office Hours**
Your lab TA will hold an office hour every week, and will inform you of the time and place.

**Tutoring**
Room 124 Smith Hall is the site of regular Chem 1062 drop-in tutorial sessions conducted by general chemistry TAs. For details, see [http://genchem.chem.umn.edu/chem-10621066/tutor-room-schedule](http://genchem.chem.umn.edu/chem-10621066/tutor-room-schedule)

**Student Solutions Manuals**
The *Student Solutions Manual* for the Silberberg and Amateis text (8th Ed.) is available in the Reserve room in the basement of Walter Library. It has detailed solutions to the red-numbered problems, for which short answers are also listed in Appendix E. Solutions Manuals for the 6th Ed. are also available. These materials can be borrowed for 3 hours (or overnight after 5 PM and returned by one hour after the library opens the next day). For Walter course reserves, call Tim Engelstad at 612-624-3897 or go to [https://www.lib.umn.edu/course/ CHEM/1062](https://www.lib.umn.edu/course/ CHEM/1062)

**Credits and Workload Expectations**
One credit is defined as equivalent to an average (over a full semester) of three hours of learning effort per week necessary for an average student to achieve an average grade in the course. For example, a student with an average level of preparation who is taking a 3 cr., 3 lecture-per-week course, such as CHEM 1062, should expect to spend an *additional 6 hr/week outside of class* on homework to achieve a grade in the B- or C+ range.

**Scholastic Dishonesty**
The U of M Student Conduct Code defines scholastic dishonesty as:

...*plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis.*


A student responsible for scholastic dishonesty can be assigned a penalty up to and including an "F" or "N" for the course. If you have any questions regarding the expectations for a specific assignment or exam, ask. As noted above, the policy in our General Chemistry courses is that the presence or use of a programmable or graphing calculator, a smartphone or any other unauthorized electronic devices during an exam will be considered scholastic dishonesty. If a student is guilty of scholastic dishonesty, the instructor will assign a grade of zero on the work involved and will report the matter to the student's college Scholastic Conduct Committee.

If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonest in the context of a particular class; e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam. The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: [http://www1.umn.edu/oscai/integrity/student/index.html](http://www1.umn.edu/oscai/integrity/student/index.html)

**Students with Disabilities**
Students with disabilities affecting their ability to participate in class or to meet all course requirements are encouraged to bring this to the attention of the Disability Resource Center (DRC, 626-1333, drc@umn.edu, [https://diversity.umn.edu/disability/](https://diversity.umn.edu/disability/)). Students who have an accommodation letter from DRC must schedule to take their exams at the DRC under their
Supervision at the Alumni Center. It is the student's responsibility to contact DRC at least two weeks in advance to schedule their exam with them. In either case, the student is responsible for providing the instructor with a copy of the accommodation letter from DRC at least two weeks prior to the first exam.

**Student mental health and stress management:** As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via [http://www.mentalhealth.umn.edu/](http://www.mentalhealth.umn.edu/).

**Teaching and learning, student responsibilities:** The materials provided in this course are intended only for the students officially enrolled in this section and are to be used to learn and practice the course material. **Disseminating class notes, videos, exams, etc. beyond the classroom community** or accepting compensation (in the form of cash or trade, such as access to a study website) violate shared norms and standards of the academic community and are not allowed. For additional information, see: [http://www.policy.umn.edu/Policies/Education/Education/STUDENTRESP.html](http://www.policy.umn.edu/Policies/Education/Education/STUDENTRESP.html)

**Additional Links**

[http://www.policy.umn.edu/Policies/Education/Education/SYLLABUSREQUIREMENTS.html](http://www.policy.umn.edu/Policies/Education/Education/SYLLABUSREQUIREMENTS.html)

1. Grading and transcripts:
   [http://www.policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html](http://www.policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html)

2. Makeup work for legitimate absences:
   [http://www.policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html](http://www.policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html)

3. Academic freedom and responsibility:

4. Sexual harassment:

5. Equity, diversity, equal opportunity, and affirmative action:
Physical science liberal education statement for CHEM 1062

CHEM 1062 satisfies the U of M Liberal Education Physical Science Core requirement. What does this mean? Core courses are intended to provide an in-depth look at how knowledge is created in a particular discipline. Naturally, they provide content knowledge but just as important, they teach “modes of inquiry”: How do workers in a particular field think? How do they collect and process information? How do they create new knowledge? By taking a distribution of core courses during your time at the U of M, you gain an appreciation for the similarities and differences among disciplines. Much like learning a foreign language helps you to better understand your own language, a distribution of core courses provides the perspective needed to understand a broad range of complex issues and can ultimately make you a better practitioner of your own chosen field. You learn different approaches to finding credible information, analyzing information, solving problems, and drawing reasonable conclusions based on facts. In doing so, you develop skills needed to be an informed citizen and life-long learner.

In CHEM 1062, we study chemistry, of course. For example, we learn to understand chemical reaction rates, equilibrium, thermodynamics, and electrochemistry. We describe how these topics fit together to form a beautiful and coherent picture, allowing us to understand and make useful predictions about the world. To accomplish this, we do what scientists do all the time: We create ideas and then test their validity by applying them to new situations. Moreover, using the language of mathematics, we translate these ideas into quantitatively testable statements. We will pose and solve many problems in this course and, by working through them yourself, you are, in effect, doing what scientists do – you’re taking concepts their mathematical incarnations and using them to gain understanding and make predictions. You’re doing the work of the field.

This aspect of the course is particularly emphasized in the co-requisite laboratory course. In the lab, you do experiments. You test hypotheses. You take data, and manipulate those data so as to allow them to provide the clearest possible picture of the phenomenon you are studying. In some cases, you will also use the understanding obtained to offer workable solutions to practical problems. This is the way scientists approach the world and, in following suit, you get at the core of one important aspect of human endeavor.

Student learning outcomes for CHEM 1062

In this course, you will

Master a Body of Knowledge and a Mode of Inquiry – We will cover a lot of useful principles of chemistry. However, these are not disconnected principles. They are tied together by some common threads and constitute a “body” of knowledge that has applications in many other areas. How to approach and apply this knowledge involves the practicing the “mode of inquiry” used routinely by chemists and, indeed, all scientists.

Identify, Define, and Solve Problems – Aside from the principles themselves, think of this course as a vehicle for practicing problem solving and critical thinking. We will solve lots of problems in this class, but the solutions require conceptual understanding and true synthesis of ideas. This course is a place to step beyond algorithmic thinking.

Can Locate and Critically Evaluate Information – You will have lots of new information in front you in this course. As you solve problems, half the challenge is figuring out what information is
pertinent to any particular problem! This learning outcome is significantly strengthened in the companion lab course, where you will be involved in extended, open-ended assignments.

_Understand the Role of Creativity, Innovation and Discovery Across Disciplines_ – Most people don't think about science as a creative endeavor. But it is! Scientists are always trying to explain what’s around them in terms they can understand and this sometimes takes real creativity! We will be discussing ideas created by some of the great geniuses of all time. As you take this course, think about what it must have taken for people to discover and shape these ideas. Note how physics and math blend seamlessly with chemistry, and how chemistry blends with almost every aspect of our lives and society.

_Acquire Skills for Effective Citizenship and Life-Long Learning_ – Chemistry plays a central role in many societal issues and the knowledge and critical thinking skill developed in this course provide a foundation for informed decision making and effective citizenship. Whenever possible, we will make connections to the “real world”.

SCHEDULE OF LECTURES, ASSIGNED READING AND ASSIGNED PROBLEMS

This schedule will be adhered to as closely as possible, but some changes may be necessary. A few notes: (1) Concept Review Questions check your understanding of the reading. Most do not require calculations and they are good thought questions well worth answering. (2) Skill-Building Exercises are presented in pairs (one black, one red) of similar problems. If you don’t feel confident after working a problem, work its “partner” to reinforce your learning. If you do not do the ALEKS online learning system, you should do at least the suggested homework problems and more if you need more practice. Assigned problems are not collected for grading.

Chapter 16 (Kinetics: Rates and Mechanisms of Chemical Reactions)

Read Sections: 16. 1-7 & 24. 2
Problems: 16. 4, 7, 9, 12, 13a, 14, 17, 18, 21, 23, 25, 26, 28, 30, 32, 34, 35abc, 36, 37abcd, 39, 43, 44ab, 48, 51, 52, 59, 60, 61, 63, 66, 67, 68, 70, 73abc, 76, 77, 78, 80, 81abc, 84, 85, 88ab, 90, 93, 94, 95, 96c, 98, 99, 103a, 106, 114, 117, 119, 124, 125.

Chemical Content: Why study kinetics? Topics include reaction rates, rate laws, determining the form of the rate law, method of initial rates, reaction order, integrated rate laws, first order kinetics and exponential decay, examples of first order kinetics, $^{14}$C dating, second order kinetics, reaction mechanisms, collision model, temperature dependence of reaction rates, catalysis, enzymes, free radical reactions and ozone depletion

Chapter 17 (Equilibrium: The Extent of Chemical Reactions)

Read Sections: 17. 1-6
Problems: 17. 2, 3, 4, 6, 10, 11, 12, 15abc, 16, 19abc, 21bc, 23, 25, 27, 30ab, 31, 33, 35, 39, 40, 42, 44, 45, 47, 50, 51, 54, 56, 58, 60, 63, 66ab, 67, 69, 71, 74, 76, 78a, 84, 86, 88, 90ab, 95a, 97ac, 102, 103, 109a

Chemical Content: The equilibrium condition, reaction quotient and K$_{eq}$, expressions involving pressures, heterogeneous equilibria, applications of the equilibrium constant, solving equilibrium problems. Le Chatelier's Principle, effect of temperature on the equilibrium constant.
Chapter 18 (Acid-Base Equilibria)

Read Sections: 18. 1-9
Problems: 2, 5ab, 8ac, 9, 11, 13, 16acd, 17abd, 19 (for H2O), 21ab, 22, 23, 25, 27, 29, 31, 36, 37, 38, 39, 40, 41, 42, 43, 45ab, 47, 48, 49, 55, 63, 65, 66, 69P, 76, 96, 98, 100ab, 103, 105, 107, 110ab, 111, 112b, 118, 122ab, 124bc, 133, 134, 138ab, 143ac, 144, 147, 149abcd, 152, 155, 158, 159ab, 161, 163, 165ab, 166, 167ab, 168, 172, 174a, 178, 186abd.

Chemical Content: Nature of acids and bases, household acids and bases, conjugate acid-base pairs, Arrhenius and Bronsted-Lowry definitions, strong acids vs. weak acids, acid dissociation constant, ion product of water, pH and pOH of strong and weak acids and bases. Percent dissociation, acid-base properties of salts, Lewis acids and bases, molecular properties and acid strength.

Chapter 19 (Ionic Equilibria in Aqueous Systems)

Read Sections: 19. 1-3
Problems: 19. 1, 4, 5, 7, 8, 9, 13, 19, 21, 24, 26, 27, 30, 31a, 33, 38, 39, 42, 44, 45, 46, 47, 52b, 54, 55, 56, 58a, 60, 107a, 112, 116, 118, 120abH, 127, 132, 133, 139, 145, 147a, 63, 64, 65, 66abc, 70, 73, 74ab, 76, 79, 84, 88, 110, 113a, 126, 128, 130, 137, 140ab

Chemical Content: Common Ion Acid-Base Equilibria, Buffered Solutions, Henderson Hasselbalch Equation, Titration and pH Curves, Indicators, Solubility Equilibria, Common Ion Effect.

Chapter 20 (Thermodynamics: Entropy, Free Energy, and the Direction of Chemical Reactions)

Read Sections: 20. 1-4
Problems: 20. 5, 8, 12, 18, 20(a,b), 23(b), 24, 27(c), 29(b), 33(a,b), 35, 43, 46, 51(b,c), 53(b,c), 55, 60, 61, 63, 64, 65, 69(b), 71(a,c), 73, 77, 79, 80, 83, 84, 85, 88, 96, 102

Chemical Content: Spontaneous processes and entropy, entropy and the 2nd Law of Thermodynamics, effect of temperature on spontaneity, free energy, entropy changes in chemical reactions. 3rd Law of Thermodynamics, standard free energies, predicting the sign of ΔS°. Relationship between free energy and equilibrium, temperature dependence of equilibrium constant, free energy and work.
Chapter 21 (Electrochemistry: Chemical Change and Electrical Work)

Read Sections: 21. 1-7
Problems: 21. 2, 9, 10(a-e), 27, 33(a), 34(a), 37, 40, 42(c), 46, 50, 53, 55, 58, 62, 64, 65, 70, 72, 73, 82, 85, 87, 101, 109, 111, 127, 133, 153(a,b,c)

Chemical Content: Basic Definitions, Galvanic Cells, Half Cells, Cell Potential, Standard Reduction Potentials, Nernst Equation, Dependence on Concentration, Concentration Cells, Electrical Work, Electrolysis

Chapter 23 (The Transition Elements and Their Coordination Compounds)

Read Sections: 23. 1,2,3,4
Problems: 23. 3, 4, 6(a,b), 12(b,c), 14, 16, 37, 40, 45(b), 47(b), 49, 50(b), 52(b), 53, 55(b), 58(b), 61, 66(b,c), 67, 69(c), 79, 80, 82(c), 88(a,c), 89(a), 92, 98, 109, 111, 115

Chemical Content: Survey of Transition Metals, Electron Configurations and Oxidation States, Coordination Compounds, Isomerism, Bonding in Complex Ions, Crystal Field Theory, Octahedral Complexes and Other Geometries, Biological Importance of Coordination Complexes.
This is the equation sheet that will be provided with all of our exams this semester:

ΔT_f = i K_f m
ΔT_b = i K_b m
Molarity (M) = mol solute / L solution
P_{solvent} = X_{solvent} P^0_{solvent}
S_{gas} = kT P_{gas}
Molarity (m) = mol solute / kg solvent

rate = k : \ [A]_t = -kt + [A]_o
rate = k [A] : \ ln[A]_t = -kt + ln[A]_o \ \ ln ([A]_o/[A]_t) = kt \ \ [A]_t = [A]_o e^{-kt} \ \ t_{1/2} = 0.693/k
rate = k [A]^2 : \ 1/[A]_t = kt + 1/[A]_o
k = A exp(E_a/RT)
ln (k_2 / k_1) = (-E_o/R) ((1/T_2) - (1/T_1))

K_p = K(RT)^\Delta n
ln (K_2 / K_1) = (-\Delta H^o / R) ((1/T_2) - (1/T_1))
x = (-b \pm (b^2-4ac)^{1/2}) / (2a)
pH = pK_a + log ([base] / [acid])

\Delta S_{surr} = -\Delta H_{sys} / T
\Delta G^o = \Delta H^o - T\Delta S^o
\Delta G = \Delta G^o + RT \ln Q = RT \ln(Q/K) = 2.303 \ RT \log(Q/K)
ln K = -\Delta H^o / RT + \Delta S^o / R

\Delta G^o = -nF E_{cell}^o
log K = n E_{cell}^o / 0.0592 V \ \ \ \ \ \ \ \ \ (at 25°C)
E_{cell} = E_{cell}^o - (0.0592 V / n) \log Q \ \ \ \ \ \ \ \ \ (at 25°C)
E_{cell} = -2.303 (RT/nF) \log (Q/K)

Spectrochemical series: I^- < Cl^- < F^- < OH^- < SCN^- < NH_3 ...< en (ethylenediamine) < NO_2^- (N-bonded) < CN^- < CO

R = 8.314 J/(mol·K) = 0.08206 (atm·L)/(mol·K)
N_A = 6.022 x 10^{23} /mol
e = 1.602 x 10^{-19} C
F = 9.649 x 10^4 C/mole
1. amu = 1.661 x 10^{-27} kg
1. atm = 760 torr
0°C = 273.15 K; \ T(°C) = (5/9) [T(°F) - 32]
mp of H_2O = 0° C; \ bp of H_2O = 100° C
1. cm^3 = 1. mL \ \ \ \ \ \ 1. Å = 1. x 10^{-8} cm = 1. x 10^{-10} m; \ 1. nm = 1. x 10^{-9} m; \ 1. pm = 1. x 10^{-12} m
ln a \approx 2.303 \log a \ \ \ \ \ \log 2 = 0.3 \ \ \ \ \ \log 3 = 0.5 \ \ \ \ \ \log 4 = 0.6 \ \ \ \ \ \log 5 = 0.7