Class Meetings: MWF 10:10 AM Fulmer 226; Dr. Paul Buckley  
MWF 12:10 PM Todd 130; Dr. Qiang Zhang

Tutorial and Laboratory times are by section. Please consult your course schedule.

Important Contact Information:
Instructors:  
Dr. Paul Buckley    Fulmer 120    335-8282   email: ptbuckley@wsu.edu  
Office Hours: Tuesday 11 am – 12, Thursday 1 pm – 2, or by appointment

Dr. Qiang Zhang    Troy 220    335-1269   email: q.zhang@wsu.edu  
Office Hours: M and W, 1 – 2 pm, or by appointment

General Chemistry Office:  
Nikki Clark Fulmer 319A  335-1516 nikki.clark@wsu.edu

Laboratory Supervisor:  
Ryan Rice    Fulmer 309  335-6358 rwrice@wsu.edu

Assessments, Grading, and Points:

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Points</th>
<th>Grade Ranges: (minimum points to achieve)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 midterm exams</td>
<td>300</td>
<td>900 points  A      740 points  C+</td>
</tr>
<tr>
<td>Final Exam</td>
<td>160</td>
<td>870 points  A-    700 points  C</td>
</tr>
<tr>
<td>14 Homework sets (best 12)</td>
<td>120</td>
<td>840 points  B+    670 points  C-</td>
</tr>
<tr>
<td>~40 Learning Catalytics Sets (best 35)</td>
<td>140</td>
<td>800 points  B    640 points  D+</td>
</tr>
<tr>
<td>12 laboratory reports (best 10)</td>
<td>250</td>
<td>770 points  B-   600 points  D</td>
</tr>
<tr>
<td>Tutorial Participation</td>
<td>30</td>
<td>Less than 600 points: F</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1000</td>
<td></td>
</tr>
</tbody>
</table>

Midterm Exams  
Thursday    Sep 20    6:00– 7:30 pm  
Thursday    Oct 18   6:00– 7:30 pm  
Thursday    Nov 15   6:00– 7:30 pm  
Final Exam  
Thursday    Dec 12   7:00 pm

Prerequisites  
1. You must have passed Chemistry 105 or its equivalent with a grade of C or better.  
2. You must have passed or been placed beyond Math 106 or Math 108 or the equivalent. Courses that are considered beyond Math 107 are Math 140, 171, 172, 182, or 202.

Course Objectives, Learning Goals, and Expected Outcomes:

Chemistry 106 is designed to advance students toward the WSU Learning Goals, especially Scientific Literacy, Critical and Creative Thinking, Quantitative Reasoning, and Information Literacy. In particular, students who successfully complete Chemistry 106 will be able to:

1. Complete the development of an understanding of the concepts, models, and theories that form a foundation for the field of chemistry (the understanding of how the behavior of matter is determined by the properties of atoms and molecules) begun in Chemistry 105.
2. Learn the principles of thermodynamics as they apply to chemical equilibrium, including the relationships between equilibrium constants, free energy, enthalpy and entropy.
3. Apply the principles of equilibrium to solubility, pH, and electrochemical equilibrium in aqueous solution.
4. Learn and apply the principles of chemical kinetics as they apply to chemical reactions in general and how they are linked to and contrasted with equilibrium principles.
5. Learn and apply the principles of nuclear reactions, half-life and radiation safety.
What Materials Do I Need For This Class?


**Mastering Chemistry Online, Learning Catalytics:** First Day (Direct Digital Access).

**Laboratory Notebook:** Available in Fulmer 401 the first two weeks of class, and at the Bookie. Laboratory experiments are posted on the class Bb site, in “Chemistry 106 Labs”. You can print a hard copy ahead of time, or bring your laptop/tablet to lab.

**Goggles:** Required by State Law. (Sold in Fulmer 401 the 1st and 2nd week of class and at the bookstores.)

**Lab Coat:** Required for Chem 106. Sold in Fulmer 401 the 1st and 2nd week of class and at the bookstore.

**Calculators:** A scientific calculator, which you are responsible for bringing to all tutorials, lectures, labs, and exams. Any programmable or web-enabled calculator, or one with the capacity to store information such as the TI N-spire, or calculators with a full keyboard (such as the TI-92 or Voyage 200); tablets, laptops and cell phone/calculator combinations may not be used during exams. Apple watches may not be worn during exams.

**Course Structure:**

**Lectures:** Lectures must be attended on a regular basis, and you are expected to read the textbook BEFORE coming to class. Lectures will supplement and clarify the information from your text rather than reiterate it, and provide group-based problem solving sessions.

**Learning Catalytics:** Each class meeting will involve on online question and response component, requiring a WiFi-enabled device. You will log in to each session through the Blackboard link, and answer the questions posed to you by the instructor throughout the class period. This system also allows you to submit questions to the instructor or indicate you do not understand the material, giving real-time feedback to your instructor. Each assignment is graded on both participation (50%) and correctness of answers (50%), and pro-rated to a maximum value of 4 points. Unauthorized use of electronic devices (web surfing, texting, social media, etc...) is not tolerated during class time, and may result in the loss of learning catalytics points for the day.

*Please note that you must log in to Learning Catalytics through the course Blackboard site. Logging in through your account in a different class, or through the Pearson website will result in a forfeiture of the Learning Catalytics points for the day, as your scores will not transfer to the Mastering Chem gradebook.*

**Homework:** We will use the Mastering Chemistry homework assignment system, and there will be a new assignment each week. The due date/time for each assignment will be listed with the assignment on the homework site, but is typically 7:00 AM on Tuesdays. Each homework set is pro-rated to a maximum value of 10 points.

**Tutorials:** These are small classroom meetings associated with your laboratory section and led by your TA. They feature group-based, guided inquiry exercises and worksheets. There are 35 course points associated with tutorial participation. Attendance is mandatory.

**Exams:** Exam questions will a combination of multiple choice, and “show your work” hand written calculations. Appeals about grading on hand-written questions will be first through your TA. If your TA cannot resolve the issue, the TA will present the appeal to the professor.

**Laboratories:**

**Pre-laboratory assignments:** Pre-laboratory assignments are completed online through Blackboard, and are due at 7:00AM Tuesday the week of that experiment, regardless of your lab section. They are typically worth 5 points, included as part of the overall lab report score.

**Laboratory procedure:** Each student will record all data and observations for each experiment directly into their own laboratory notebook. You are required to get your TA’s approval on your data entries before you leave lab, or risk receiving no credit for your lab report.
Laboratory reports: You must submit an electronic copy of your lab report (PDF only!) through Blackboard for online grading, and as a plagiarism check. In most cases, the laboratory reports are due for online submission by 11:59 pm on Wednesday of the week following your lab experiment, regardless of your lab section. Consult the schedule at the end of this syllabus for exceptions.

Laboratory dress code: For your safety, a strict dress code is enforced in the laboratory. The dress code requires that you be fully clothed from shoulder to toe. No shorts, short skirts, or shoes that do not entirely cover your legs, ankles, and feet are permitted. Students not complying with the dress code are not allowed to perform the lab experiment.

Keeping the Lab Safe and Orderly: Goggles and lab coats must be worn at all times when in the lab. It is also your responsibility to maintain an orderly workspace, to clean up spills at your bench and near balances immediately, and to clean your work station before you leave. TAs may deduct up to five points from your lab report scores for violations of these rules.

Adjustments to laboratory scores: The instructor will make every effort ensure that the grading of laboratory reports is consistent and fair. To this end, the instructor reserves the right to normalize the laboratory scores from the different laboratory instructors to the same average. Any such adjustment will be made at the end of the semester after all scores have been submitted. TA performance will be assessed throughout the semester with the goal of eliminating any necessity for these adjustments. Students are encouraged to bring any concerns about the equity of the grading process to the attention of the course instructor.

Class Policies on Late and Missed Exams, Assignments, and Lab Experiments (The Rules):
Exams: No make-up exams will be given. If you are unable to take a scheduled midterm exam for academic reasons beyond your control, you will be allowed to schedule the exam at an earlier time. A midterm exam missed due to documented illness will be excused, with the average score from your other exams used as the missed exam score. Exams end precisely at the designated time, regardless of when you arrive to the exam. The exam graders reserve the rights to deduct partial or all points if the answers are not written in a clear and readable fashion.

Homework: No late assignments will be accepted. Instead, your two lowest homework scores will be dropped, with your late homework assignment counting as zero points.

Tutorials: Students who arrive late or miss the tutorial will not be allowed into the lab. Tutorial sessions are never canceled! If your TA fails to arrive for a tutorial section, send one person to contact the General Chemistry office (335-1516, Fulmer 319A) immediately. Leaving a tutorial under these circumstances is considered equivalent to not attending tutorial.

Pre-lab Assignments: Students who do not submit a complete pre-lab assignment by the start of tutorial will lose the pre-lab points, and are required to complete the pre-lab assignment before they are admitted to lab. If you are sent by your TA to complete the pre-lab, you may do so in Fulmer 401, and will need to get a verification slip from Nikki Clark (Fulmer 319A). You will not be given extra time in the laboratory to make up for laboratory time spent completing the pre-lab.

Data and Observation Pages: These are from your notebook, and you must get your TA to sign your data pages, and then submit them to your TA before you leave the lab. No data pages that have left the lab without a TA signature may be handed in for credit.

Laboratory reports: Late laboratory reports are not accepted. Failure to submit an on-time laboratory report for an experiment will result in zero credit for that experiment (no credit will be given for the pre-lab or data & observations sections in the absence of a full report).

- No makeup labs will be scheduled
- Your two lowest lab report scores will be dropped from your course point total (including zeroes from missed labs, or labs with no lab report submission)
- A third missed lab or lab report submission is scored as a zero, which does count in your course point total
- A fourth score of zero for a lab report (regardless of the reason) results in a failing grade for the class.
- Points from lab reports submitted beyond the 10 lab report submission minimum are returned to the student as extra credit, at 50% of their nominal value (maximum 12.5 points per lab report)

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How Do I Get Help?

**Professor's Office Hours:** The hours are listed on the first page of this syllabus. You are encouraged to visit office hours for help, or to simply introduce yourself and let us know how the course is going for you. The more specific you are with your questions, the more we are able to help you.

**TA Office Hours:** All chemistry TAs hold their office hours in Fulmer 401. The schedule will be posted on Blackboard. You may ask any Chem TA for help in this course, regardless of the course they are associated with.

**Electronic Communications:** E-mail communications with Faculty and TAs are welcomed, but you MUST send email from your WSU email account, and start with Chem 106 in the subject line, otherwise you risk no response.

**Free Tutoring:** Available in Fulmer 401 M-F.

Classroom Safety Statement
Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the “Alert, Assess, Act” protocol for all types of emergencies and the “Run, Hide, Flight” response for an active shooter incident. Remain ALERT (through direct observation or emergency notification), ASSESS your specific situation, and ACT in the most appropriate way to assure your own safety (and the safety of others if you are able).

Please sign up for emergency alerts on your account at MyWSU. For more information on this subject, campus safety, and related topics, please view the FBI’s Run, Hide, Fight video and visit the WSU safety portal.

Expectations for Student Effort
As per WSU academic regulation 27, “Academic credit is a measure of the total minimum time commitment required of a typical student in a specific course. For the WSU semester system one semester credit is assigned for a minimum of 45 hours. Achievement of course goals may require more than the minimum time commitment.” This guideline includes time spent in class.

This guideline essentially states that a student can be reasonably expected to spend two hours outside of class on assignments for every one hour spent in class, or six hours per week outside of class for a three-credit course such as this. This is approximately the amount of time you should expect to spend on viewing pre-class videos, reading the textbook, and doing assigned problem solving exercises.

Attendance Policy
It is expected that on-campus students attend every class meeting. Attendance will not be taken in class, but the use of Learning Catalytics is effectively a check on attendance. Missing class will result in missing a Learning Catalytics assignment, and will be counted towards your “dropped” assignments in that assignment category.

Academic Integrity
Academic integrity is the cornerstone of higher education. As such, all members of the university community share responsibility for maintaining and promoting the principles of integrity in all activities, including academic integrity and honest scholarship. Academic integrity will be strongly enforced in this course. Students who violate WSU’s Academic Integrity Policy (identified in Washington Administrative Code (WAC) 504-26-010(3) and -404 will receive a score of zero for that assignment or exam for the first instance. A second incident of cheating will result in an F for the course, without the option to withdraw from the course pending an appeal. All violations of the WSU Academic Integrity Policy will be reported to the Office of Student Conduct.

Cheating includes, but is not limited to, plagiarism and unauthorized collaboration as defined in the Standards of Conduct for Student: Washington Administrative Code (WAC) 504-26-010(3), found here: [http://app.leg.wa.gov/WAC/default.aspx?cite=504-26-010](http://app.leg.wa.gov/WAC/default.aspx?cite=504-26-010). If you have any questions about what is and is not allowed in this course, ask the course instructors before proceeding.

- Cheating or plagiarism in any form will not be tolerated.
- Cheating includes, but is not limited to: copying work OR allowing your work to be copied; use of unauthorized material at exams, any communication between students during an exam, and actively looking at another student’s paper during an exam.
- Submission of identical data by two or more students who are not assigned to be laboratory partners will be considered cheating. Appropriate penalties will be applied to all parties.

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- Students repeating the course must rework and rewrite all assignments. Plagiarism includes resubmitting previously graded homework or lab reports from a previous semester, even if they were your own work.
- Plagiarism also includes using laboratory data from another person or a previous semester.
- Use of any electronic device other than an approved calculator during an examination is cheating.

**WSU Reasonable Accommodation Statement**

“Students with Disabilities: Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center [Pullman] or Disability Services at [name of campus] address on your campus] to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center or Disability Services. For more information contact a Disability Specialist on your home campus.”

**Pullman or WSU Online:** 509-335-3417, Washington Building 217; [http://accesscenter.wsu.edu, Access.Center@wsu.edu](http://accesscenter.wsu.edu)

<table>
<thead>
<tr>
<th>Student Learning Outcomes-</th>
<th>Course Topics/Dates-</th>
<th>Evaluation of Outcome-</th>
</tr>
</thead>
<tbody>
<tr>
<td>At the end of the course, students should be able to:</td>
<td>The following topics will address this outcome:</td>
<td>This outcome will be evaluated primarily by:</td>
</tr>
<tr>
<td><strong>Complete the development</strong> of an understanding of the concepts, models, and theories that form a foundation for the field of chemistry begun in Chemistry 105.</td>
<td>Intermolecular Forces, Kinetics, Chemical Equilibrium, Acids and Bases, Thermodynamics, and Electrochemistry.</td>
<td>Homework assignments Lab Reports Learning Catalytics Midterm and Final Exams</td>
</tr>
<tr>
<td><strong>Learn the principles</strong> of thermodynamics as they apply to chemical equilibrium, including the relationships between equilibrium constants, free energy, enthalpy and entropy.</td>
<td>Chemical Equilibrium, Thermodynamics</td>
<td>Homework assignments Lab Reports Learning Catalytics Midterm and Final Exams</td>
</tr>
<tr>
<td><strong>Apply the principles</strong> of equilibrium to solubility, pH, and electrochemical equilibrium in aqueous solution.</td>
<td>Chemical Equilibrium Acids and Bases Electrochemistry</td>
<td>Homework assignments Lab Reports Learning Catalytics Midterm and Final Exams</td>
</tr>
<tr>
<td><strong>Learn and apply the principles</strong> of chemical kinetics as they apply to chemical reactions in general and how they are linked to and contrasted with equilibrium principles.</td>
<td>Chemical Kinetics Chemical Equilibrium</td>
<td>Homework assignments Lab Reports Learning Catalytics Midterm and Final Exams</td>
</tr>
<tr>
<td><strong>Learn and apply the principles</strong> of nuclear reactions, half-life and radiation safety.</td>
<td>Radioactivity and Nuclear Chemistry</td>
<td>Homework assignments Learning Catalytics Midterm and Final Exams</td>
</tr>
</tbody>
</table>
# Tentative Topic Schedule (Subject to Modification)

<table>
<thead>
<tr>
<th>Dates</th>
<th>Chapter</th>
<th>Topics</th>
<th>Lab Experiment</th>
<th>Lab Report Due</th>
<th>Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Aug 20 - 24</td>
<td>11</td>
<td>Intermolecular Forces</td>
<td>No Lab. Tutorial mandatory.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Aug 27 - 31</td>
<td>11, 13</td>
<td>IM Forces, Solutions</td>
<td>Colorimetry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3* Sept 3 - 7 Labor Day Hol.</td>
<td>13, 14</td>
<td>Solutions, Chemical Kinetics</td>
<td>Colligative Properties</td>
<td>Colorimetry</td>
<td></td>
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<tr>
<td>4 Sept 10 - 14</td>
<td>14</td>
<td>Chemical Kinetics</td>
<td>Kinetics I</td>
<td>Colligative Properties</td>
<td></td>
</tr>
<tr>
<td>5 Sept 17 - 21</td>
<td>14, 15</td>
<td>Chemical Kinetics</td>
<td>Kinetics II</td>
<td>Kinetics I</td>
<td>Exam 1 Sept 20</td>
</tr>
<tr>
<td>6 Sept 24 - 28</td>
<td>15</td>
<td>Chemical Equilibrium</td>
<td>Determine an Equilibrium</td>
<td>Kinetics II</td>
<td></td>
</tr>
<tr>
<td>7 Oct 1 - 5</td>
<td>16</td>
<td>Equilibrium, Acids and Bases</td>
<td>Le Chetaltier's Principle</td>
<td>Equilib Constant</td>
<td></td>
</tr>
<tr>
<td>8 Oct 8 - 12</td>
<td>16</td>
<td>Acids and Bases</td>
<td>Titration of a Polyprotic Acid</td>
<td>Le Chetaltier's Princ</td>
<td></td>
</tr>
<tr>
<td>9 Oct 15 - 19</td>
<td>16, 17</td>
<td>Acids and Bases</td>
<td>Ksp Determination</td>
<td>Titration of a Polyprotic Acid</td>
<td>Exam 2 Oct 18</td>
</tr>
<tr>
<td>10 Oct 22 - 26</td>
<td>17</td>
<td>Ionic Equilibrium, pH Buffers</td>
<td>pH Buffers</td>
<td>Ksp Determination</td>
<td></td>
</tr>
<tr>
<td>11 Oct 29 – Nov 2</td>
<td>17, 18</td>
<td>pH Buffers, Entropy</td>
<td>Known Anions</td>
<td>pH Buffers</td>
<td></td>
</tr>
<tr>
<td>12 Nov 5 - 9</td>
<td>18</td>
<td>Free Energy and Thermodynamics</td>
<td>Known Anions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13* Nov 12 - 16</td>
<td>18</td>
<td>Free Energy and Thermodynamics</td>
<td>Unknown Anions</td>
<td>Known Anions</td>
<td>Exam 3 Nov 15</td>
</tr>
<tr>
<td>Nov 19 - 23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Nov 26 - 30</td>
<td>19</td>
<td>Electrochemistry</td>
<td>Voltaic Cells</td>
<td>Unknown Anions</td>
<td></td>
</tr>
<tr>
<td>15 Dec 3 - 7</td>
<td>20</td>
<td>Electrochemistry, Radiochemistry</td>
<td>Course Evaluations Online</td>
<td>Voltaic Cells</td>
<td></td>
</tr>
<tr>
<td>16 Dec 13</td>
<td></td>
<td></td>
<td>FINAL EXAM 7:00 pm December 13</td>
<td></td>
<td></td>
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* Monday Holiday, no class       # No class Friday Nov 16