Course Syllabus

Instructor: Prof. Brad Davidson
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Phone: 797-1628
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Meeting Time/Place: MWF 2:00 - 2:50 PM, Wietsoe Hall 007

Office Hours: TW 10:30 - 11:30 AM; F 9:30 - 10:30 AM

Prerequisites: MATH 1050 or equivalent; CHEM 1210 or equivalent

Materials:
- Text - "Chemistry: The Central Science," Brown, Lemay, Bursten, and Murphy; Prentice Hall, 11th or 12th Ed (others will work fine, too).
- MasteringChemistry - If not purchased with textbook, access must be purchased separately (masteringchemistry.com)
- Scientific calculator
- iClicker

Supplemental instruction (S.I.) will also be provided for this course. Your S.I. instructor is AJ Stewart (aj.stewart@aggiemail.usu.edu). The S.I. times and locations: Monday, 5:00-5:50 PM, AGSC 141 Thursday, 6:30-7:20 PM, ENG 238

Course Web Pages: Course materials, including on-line quizzes, practice exams, recommended problems, and links to reference materials will be available on Canvas (http://online.usu.edu). Login using your A# and password.

Recitation: You must be registered for a recitation section (CHEM 1220 sections 501-504). Recitations will involve guided, group problem sessions. Participation in each recitation is worth 5 points to result in a total of 50 points of the final grade. Yuan Chu (yuan.chu@aggiemail.usu.edu) will be your recitation leader.

Tentative Course Outline and Exam Schedule:

<table>
<thead>
<tr>
<th>DAY</th>
<th>DATE</th>
<th>#</th>
<th>TOPIC</th>
<th>CHAPT</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>8/27</td>
<td>1</td>
<td>Intro, Reaction Rates and Stoichiometry</td>
<td>14</td>
<td>Pre-Quiz, No Recitation</td>
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<tr>
<td>W</td>
<td>8/29</td>
<td>2</td>
<td>1st and 2nd order, half lives</td>
<td>14</td>
<td></td>
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<tr>
<td>F</td>
<td>8/31</td>
<td>3</td>
<td>Temperature and Rates</td>
<td>14</td>
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<tr>
<td>M</td>
<td>9/3</td>
<td></td>
<td>Labor Day - No Class</td>
<td></td>
<td></td>
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<tr>
<td>W</td>
<td>9/5</td>
<td>4</td>
<td>Reaction Mechanisms, Catalysis</td>
<td>14</td>
<td>Quiz 1, HW-1, Recitation 1</td>
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<tr>
<td>F</td>
<td>9/7</td>
<td>5</td>
<td>Chemical Equilibrium</td>
<td>15</td>
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<tr>
<td>M</td>
<td>9/10</td>
<td>6</td>
<td>Equilibrium Constants, K_eq Calculations</td>
<td>15</td>
<td>Quiz 2, HW-2, Recitation 2</td>
</tr>
<tr>
<td>W</td>
<td>9/12</td>
<td>7</td>
<td>Applications, LeChatelier’s Principle</td>
<td>15</td>
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<tr>
<td>F</td>
<td>9/14</td>
<td>8</td>
<td>Bronsted Lowry, Autoionization of water</td>
<td>16</td>
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<tr>
<td>M</td>
<td>9/17</td>
<td>9</td>
<td>pH Scale, Strong Acids, Strong Bases</td>
<td>16</td>
<td>Quiz 3, HW-3, Recitation 3</td>
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<tr>
<td>W</td>
<td>9/19</td>
<td>10</td>
<td>Weak Acids, Weak Bases, K_a, K_b</td>
<td>16</td>
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<tr>
<td>F</td>
<td>9/21</td>
<td>11</td>
<td>Acid/Base, Salts, Lewis Acid/Base</td>
<td>16</td>
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<tr>
<td>M</td>
<td>9/24</td>
<td>12</td>
<td>Review</td>
<td>14 - 16</td>
<td>No Recitation</td>
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<tr>
<td>W</td>
<td>9/26</td>
<td></td>
<td>Exam 1 - Chapters 14, 15, and 16</td>
<td></td>
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<tr>
<td>F</td>
<td>9/28</td>
<td>13</td>
<td>Common Ions, Buffers</td>
<td>17</td>
<td></td>
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<tr>
<td>M</td>
<td>10/1</td>
<td>14</td>
<td>Acid-Base Titrations, Equilibrium</td>
<td>17</td>
<td>Quiz 4, HW-4, Recitation 4</td>
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<tr>
<td>W</td>
<td>10/3</td>
<td>15</td>
<td>Solubility</td>
<td>17</td>
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<tr>
<td>F</td>
<td>10/5</td>
<td>16</td>
<td>Complex Ions</td>
<td>17</td>
<td></td>
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<tr>
<td>M</td>
<td>10/8</td>
<td>17</td>
<td>Precipitation</td>
<td>17</td>
<td>Quiz 5, HW-5, Recitation 5</td>
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Exams: There will be three in-class midterm exams (50 min) and one comprehensive final exam (110 min) for this course, covering material presented in the lecture, the textbook, the recitation, and from the homework and quizzes. The midterm exams will include 25 multiple-choice questions, each worth 4 points (100 points each), while the final exam will include 50 questions, each worth 4 points (200 points total). You need to bring a calculator and #2 pencil to the exam. No iphones or ipads are allowed.

Extra Credit: For each exam, a "Topic of Interest" will be selected. An extra credit question pertaining to the "Topic of Interest" worth 4 pt will be offered on each exam.

MasteringChemistry: We will be using the MasteringChemistry platform for all on-line homework and quizzes. You can access MasteringChemistry through the "On-line Homework/Quizzes" link on the course homepage or at masteringchemistry.com. If you did not still have access from taking Chem 1210 during the S2012 semester, you will need to register using the access code purchased with you textbook or purchased separately at the masteringchemistry website. All students must enroll using the following course ID: DAVIDSON1220F12.

On-line Homework: There will be 11 on-line homework sets that will be offered through MasteringChemistry (accessed through Canvas) and must be completed on your own time. Each homework set will be start on Monday, 2:00 PM, until the due date being the following Monday, 2:00 PM. Each homework is worth 10 points if taken before the due date. Late submissions will be penalized: the credit will be reduced by 10% over each day late (with the credit never being reduced by more than 50 %). They will consist of ten tutorial type questions, having multiple parts. You will have up to 6 attempts at each question, with a slight reduction in score for each missed attempt. Hints are also available, but slight reductions in score are assessed for using hints. Your top 10 scores will apply to your overall course grade. You will benefit the most from the homework if you prepare and try to take them without help from the book or your notes.
**Quizzes:** There will be 11 quizzes offered weekly on each non-exam week through MasteringChemistry (accessed via Canvas). Each quiz is worth 10 points if taken before the due date. Grading is as described under On-Line Homework. Late submissions will be penalized: the credit will be reduced by 10% over each day late (with the credit never being reduced by more than 50%). Your top ten scores will be applied to your course grade.

**iClicker Questions:** A single question iClicker question will be given at the beginning of each MWF class period, except review days and exam days. These questions must be answered individually, but discussions with your classmates are allowed. Each question will be worth 2 pt for a correct answer and 1 pt for an incorrect answer. It is your responsibility to register you iClicker at iclicker.com and to remember to bring your iClicker, in working order, to class each day. At the end of the semester, everyone’s five lowest clicker scores will be dropped.

**Practice Problems/Tutorials:** A large number of practice problems, along with video recorded tutorials have been kindly made available to us by Dr. Scott Ensign. These can be accessed through our main webpage. The login ID: ensigns Password: tadpoles2012

**Class Notes:** Lecture outlines for each chapter will be posted on this website prior to class. Recorded lectures will then be available subsequently.

**Grading Scheme:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
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<tbody>
<tr>
<td>Three one-hour exams (3 x 100 pt)</td>
<td>300 pt</td>
</tr>
<tr>
<td>Best ten out of eleven homework sets (10 x 10 pts)</td>
<td>100 pt</td>
</tr>
<tr>
<td>Best ten out of eleven quizzes (10 x 10 pts)</td>
<td>100 pt</td>
</tr>
<tr>
<td>In-class iClicker questions (drop lowest five)</td>
<td>~50 pt</td>
</tr>
<tr>
<td>Recitation participation points</td>
<td>50 pt</td>
</tr>
<tr>
<td>Comprehensive Final</td>
<td>200 pt</td>
</tr>
<tr>
<td><strong>Total Points:</strong></td>
<td>800 pt</td>
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</tbody>
</table>

**Grade Breakdown:** The grade received in the course is based on your performance on the exams, quizzes, and homework. Grades are guaranteed as given below for overall percentage score on all exams. Actual grade ranges may be curved somewhat lower, depending on the overall class average.

- A, A- 100 - 88%
- B+, B, B- 87 - 77%
- C+, C, C- 76 - 60%
- D+, D 59 - 50%
- F <50%

**Assessment:** Assessment involves measuring student progress as well as teaching effectiveness. The following assessment strategies have been incorporated into this course.

- A pre-test/post-test approach will be used to measure comprehension and teaching of important concepts. The pre-test will be administered through Blackboard and must be taken on your own time. The ten multiple choice questions of the pre-test will reappear in the final, in slightly altered form, to assess teaching and learning progress during the semester. If weaknesses are observed in specific subject areas, teaching methods will be reevaluated. Five points will be awarded for taking the pre-test, regardless of you number of questions answered correctly.
- Student evaluations will be used to evaluate course/instructor strengths and weaknesses. Constructive suggestions are welcome anytime.

**IDEA Objectives:** A new course evaluation system will be used this year, wherein you will be able to self-access your progress in achieving the following general objectives.

1) Have you gained factual knowledge about General Chemistry, including terminology, methods, and trends, as further described in the Detailed Learning Objectives, shown below?

2) Have you learned fundamental principles, generalizations, and theories that that describe and explain chemical reactions and chemical properties?

3) Have you further developed your ability to analyze and critically evaluate ideas, arguments, and scientific models.

**Detailed Learning Objectives for Chem 1220:**

**Chapt 14:** Describe reaction rates in terms of zero, 1st, 2nd, 3rd order processes
Describe reaction rates as a function of temperature
Predict reaction half-lives given initial conditions
Differentiate between the plots of 1st order and 2nd order reactions
Describe the action of catalysis on a chemical reaction
Describe reactions in terms of elementary steps and rate-determining steps

Chapter 15:
Write equilibrium constant expressions
Perform calculations of concentrations, pressures using \( K_{\text{eq}} \) information
Predict the direction of a reaction using the reaction quotient
Explain Le Chatelier’s Principle

Chapter 16:
Cite essential definitions of acids and bases
Utilize the autoionization of water to define pH and pOH, \( K_w \) , p\( K_w \)
Employ \( K_a \), \( K_b \) values to calculate pH, pOH of solutions of weak acids, weak bases, and salts
Describe chemical factors that contribute to the strength of acids and bases

Chapter 17:
Apply concepts of the Common Ion effect to design and construct acid/base buffer systems
Calculate acid/base titration curves and predict end-point conditions
Describe and apply \( K_{\text{sp}} \) values to determine solubility of inorganic solids
Describe the precipitation and separation of ions utilizing \( K_{\text{sp}} \) information

Chapter 18:
Describe the chemical composition of the Earth’s crust, atmosphere, and surface waters
Describe chemical reactions in the atmosphere caused by solar radiation
Describe chemical reactions related to acid rain

Chapter 19:
Describe and apply concepts of chemical spontaneity and the 2\textsuperscript{nd} Law of Thermodynamics
Describe and apply the concepts of entropy to chemical reactions
Use Gibb’s Free Energy to predict chemical equilibrium

Chapter 20:
Balance chemical reactions that involve changes in oxidation states
Express oxidation/reduction in terms of half reactions
Describe voltaic cells and calculate potentials using standard reduction potentials
Predict the spontaneity of oxidation/reduction reactions
Employ the Nernst Equation to calculate cell potentials and chemical concentrations
Describe the chemical reactions of corrosion

Chapter 21:
Describe and differentiate between fundamental types of radioactivity and radioactive processes
Predict nuclear stability based on proton/neutron ratios
Apply 1\textsuperscript{st} order kinetics for radioactive decay
Compare the energetic and mass aspects of nuclear fission and nuclear fusion

Chapter 22:
Describe the fundamental aspects of the reactivity of non-metal elements, including hydrogen, the Noble gases, the halogens

Chapter 23:
Identify the major chemical processes for purifying iron, steel, aluminum, copper, and sodium.

Chapter 24:
Describe the structure and bonding in simple coordination complexes of transition metals like Fe, Cu
Predict simple electronic configurations for transition metal ions using the periodic table
Predict magnetism using simple models of Crystal Field Theory
Discuss how the color of transition metal complexes is related to d-orbital splitting

Chapter 25:
Identify and draw the structure of hydrocarbon alkanes, alkenes, alkynes, and aromatics
Identify and draw the functional groups ethers, aldehydes, ketones, acids, esters, and amides
Identify the chemical structure of amino acids and polypeptides
Identify the chemical structure of carbohydrate sugars and fats
Identify the chemical structure of nucleic acids and DNA, RNA

Online Links to Chemistry Materials:
- Los Alamos Periodic Table Site: [periodic.lanl.gov/index.shtml](http://periodic.lanl.gov/index.shtml)
- General Chemistry Starting Points for Students: [www.chem1.com/chemed/genchem.shtml](http://www.chem1.com/chemed/genchem.shtml)
- General Chemistry Wikibook: [en.wikibooks.org/wiki/General_Chemistry](http://en.wikibooks.org/wiki/General_Chemistry)
- Website for the American Chemical Society: [portal.acs.org/portal/acs/corg/content](http://portal.acs.org/portal/acs/corg/content)
- This Week in the History of Chemistry: [web.lemoyne.edu/~giunta/week.html#29](http://web.lemoyne.edu/~giunta/week.html#29)

Suggestions:
1. Keep up with lecture and reading materials.
2. Make sure to do the on-line homework problems! In addition to helping your overall comprehension and exam performance, do not miss easy-to-obtain points.
3. Work the problems! Work the problems! Work the problems! (practice makes perfect)
4. Do practice exams under realistic conditions. Do not look at the answer key before you are done.
5. Take advantage of the SI and the instructor. Go to SI sessions and office hours.
6. Use the web sites listed above.
7. Study in groups, but make sure everyone contributes.