Syllabus – Chemistry 104, General Chemistry II (Lec 401), Summer 2018

Course Information can be found on D2L

Instructor: Dr. Christine Carlson  
Email: cac4@uwm.edu

Office: CHM 143  
Office Hours: MTW 12:15 – 1:15pm

The syllabus is subject to change. Only the most current version of this syllabus is valid. If the syllabus is changed after the start of classes, one verbal announcement will be made in lecture and the new version will be uploaded to D2L.

All emails correctly addressed will be answered within 48 hrs. To ensure that your email is correctly addressed you must include your Course number and lecture number in the subject line, ex: Chem 104 – 401. In addition, the email must be sent from your UWM email account.

Overview of the course

Chemistry 104 is the second of a two-semester sequence designed to facilitate the student’s learning of the nature of the material universe. The second semester extends the principles learned in the first semester to provide an understanding of chemical kinetics, equilibria, acid-base chemistry, and chemical thermodynamics.

Prerequisites

A grade of C or better in Chemistry 102.

Chemistry 104 is not open to students who have completed Chemistry 105, 111 or Chemistry 118 (unless the course is to be considered as a repeat of 118). In order for you to be successful in this course you will be required to perform algebraic manipulations, work with square roots and logarithms, and solve linear and quadratic equations. If you have difficulties with basic algebra, etc., you should consider dropping the course and taking it at a time when you have acquired these skills.

Dropping the Course, Changing Sections, Incompletes

All drops, adds, and section changes of Chemistry Department courses should first be attempted using PAWS. Any changes to your schedule that cannot be done using PAWS will require the stamp of the Chemistry Department. This may also require my signature. A discussion or laboratory TA can never sign an add/drop form. An incomplete can be given only for a student who has been doing satisfactory work, but is unable to complete the course for a reason which I judge to be valid, and must be accompanied by appropriate documentation.
Important dates - You will be responsible for knowing the deadlines for drops or withdrawals as determined by the University. This includes the final day to withdraw from any class for academic reasons.

Last date to ADD/SWAP – June 29th 2018. **I do not allow ADDS or SWAPS after this date.**

Last date to DROP without a W – July 6th 2018.

Last date to DROP a course – July 29th 2018 - **After this day, I will not sign any withdrawals from the course for academic reasons.**

Required Materials

Course Text:  *General Chemistry: The Essential Concepts* (7th Edition) by Chang (electronic copies are available) – expected cost range $50-$200 (depending on source)

Chemistry 104 – Lecture Activities – Summer 2018 – available by the start of classes at Clark Graphics, 2915 North Oakland – expected cost approximately $35.

Laboratory:  *Chemistry 104 Lab Manual – Summer 2018* (available by the start of classes at Clark Graphics, 2915 North Oakland) – expected cost approximately $25

Safety goggles – expected cost approximately $10

Bound laboratory notebook with duplication – expected cost approximately $15

*Safety goggles are absolutely mandatory. They must seal around the eyes and have shielded vents. You must have these prior to the first laboratory period, and they must be worn at all times while you are in the laboratory.*

Calculator:  Non-graphing or non-programmable *scientific calculator* with logarithms, exponential functions, etc. – expected cost approximately $20

Graphing calculators, cell phone calculators, laptops, pda’s, etc. are strictly forbidden in exams or quizzes. You may only use a NON-PROGRAMMABLE, scientific calculator for exams or quizzes. If you attempt to use something else which is prohibited you will be required to work with pencil and paper only.

Lectures

**Chemistry 180**  MTWR  11:00am – 12:15pm

The number of points you receive for attending lecture will be minimal. Part of the learning process involves thinking about what is being said in lecture, writing it down, and even re-writing it to clarify what you have heard.

For EVERY lecture you will be assigned a reading from the textbook and problems to work from your lecture activity book. Lecture instruction will based upon the assumption that each student has done the required reading before lecture.
**Lecture attendance:** Attendance in lecture will be recorded via a sign in sheet, which will be passed amongst the students at the start of each lecture.

Using a quiz or an exam as a means to test if you have learned something could be too late to determine you still have a gap in knowledge. **Remember, lecture is very important in seeing process and models and hearing concepts and their derivation and application BUT is not the beginning and end of learning.** It would be unusual to learn something simply from sitting in lecture. As always, seek help, seek help, seek help!

**Homework and Lecture Quizzes**

**Homework** will be assigned from the lecture activities, course manual, and textbook. This will be due in discussion quarterly throughout the summer (After exam 1, 2, and three). The final assignment will be due in lecture on the last day of lecture. **Homework from the textbook (all red-numbered problems) are assumed to be completed but will not be collected or graded.**

**Lecture quizzes** will be given every week of class (therefore 8 quizzes will be given). The lecture quizzes will be given in the last 20 minutes of the Thursday lectures. **Your highest 6 quizzes will count towards your quiz total** (with the two lowest being dropped). **There are no Early/Late/Make-up quizzes.** The only exceptions to this are verified military activities, verified student disability (ARC VISA variable attendance accommodation), religious observance verification (following university policy). Quizzes may include extra credit. Quiz solutions will be posted on D2L.

*If you believe that your quiz has been unfairly graded you must return the quiz to your TA before the end of the discussion section. He/she will get the quiz to me and I will re-grade it completely. You should be aware that if you elect to do this, your grade may be higher, the same, or lower, depending on whether or not other problems may have been graded too generously.*

**Missing a quiz for any reason results in that quiz counting as one of your drops – do not request to take a quiz at any other time since everyone can drop two quizzes.**

**Discussion Section / Problem Solving**

**You are required to attend the discussion section for which you have registered.** Attendance is discussion is important to your understanding of the material presented in lecture, for this reason 2 or the 10 possible points earned in each discussion session will be given for being present on time. Your attendance and participation in discussion sections is essential because your final grade depends critically on your ability to solve problems.

**Your highest 10 discussion grades will count towards your discussion total** (with the four lowest being dropped). **There is no means to make-up a missed discussion.** The only exceptions to this are verified military activities, verified student disability (ARC VISA variable attendance accommodation), religious observance verification (following university policy).

In order to have a positive experience in discussion, it is to your benefit to both prepare for discussion and participate. Your discussion section is your opportunity to further understand problems on a more personal basis – you can go over finer details and questions than is simply possible in lecture. Use discussion time wisely.
You can only learn to solve problems by doing them. You must attempt to solve all of the assigned problems as an absolute minimum. It is very important for you to make every attempt to solve problems before seeking help elsewhere. The solution to a problem always looks easier when someone else shows it to you. Remember that you will not be afforded this luxury on an exam.

**Make-up Discussions:** If you are aware in advance of a discussion that you will miss you need to inform me in writing (not email) at least 72 hours in advance of the date of the discussion, your discussion section, and a list of the other discussion sections that you could attend that week. All possible attempts will then be made to make room in one of the other Discussion sections for the requested discussion only so that you do not miss the discussion. This depends on available space. The only exceptions to this policy are verified military activities, verified student disability (ARC VISA variable attendance accommodation), religious observance verification (following university policy).

**Laboratory**  
**Wed June 27th or Thur June 28th** (see lab schedule on next page)

Chemistry is an experimental science – the concepts and models are based on experiment. Thus, the laboratories are designed to give you a “hands-on” experience in order to reinforce concepts. You may encounter material in the laboratory before you see the material in lecture.

- **You must attend the laboratory section for which you are registered.**
- **You must be prepared to perform the experiment before coming to lab.**
  - You will need to complete items 1 through 5 per Chapter 1 in *Laboratory Manual Section* Part 1 in your laboratory notebook for all experiments prior to the start of the lab period.
  - If you do not have this completed, you will not be allowed to do the experiment and receive a grade of zero for the lab.
- **Your completed lab report is due at the start of the first lab period of the next week. You must submit the original copy and retain the second copy.**
  - All labs for the previous week are due at the start of the first lab period of the next week.
  - You must have personally performed the experiment in lab in order to receive a grade for the associated lab report.
  - There are no early / late labs given.
    - **Make-up Labs:** If you are aware in advance of a lab that you will miss you need to inform me in writing (not email) at least 72 hours in advance of the date of the lab, your lab section, and a list of the other lab sections that you could attend that week. All possible attempts will then be made to make room in one of the other lab sections for the requested lab only so that you do not miss the lab. This depends on available space.
    - The only exceptions to this are verified military activities, verified student disability (ARC VISA variable attendance accommodation), religious observance verification (following university policy). Impossible beyond the week that the lab was originally run.
- **Your highest 10 lab grades will count towards your laboratory total** (with the one lowest being dropped).
- **Your labs will be graded following the rubric given in the lab manual, Part 1, Chapter 1.**
- **You may not have your laboratory manual at any point during the experiment. You may only use your laboratory notebook. Therefore you must have an appropriate and complete procedure in your notebook to conduct the experiment.**
- **A lab practical will be given during the last week of lab.**
  - The content of the practical will be based on your experiences in lab.
  - You WILL be performing an abbreviated version of one of the labs from this semester.
  - This is not considered a lab examination.
You will be allowed to use your bound laboratory notebook (NOT lab manual) for the practical – loose papers, textbooks or photocopies of any other source will not be permitted.

The original graded and returned lab reports are NOT permitted.

You must pass the lab practical (score of 60% or greater) in order to be eligible to pass lab.

You must pass lab (score of 60% or greater) in order to be eligible to pass this course.

Your lab reports must be your original work. Copying in any form (includes identical text on separate lab reports) is considered cheating and WILL result in a zero for the lab, in addition to possible further actions.

Safety: Wisconsin state law requires all students to wear safety goggles which seal around the eyes and have shielded vents while they are in the laboratory. This will be strictly enforced. Failure to comply will result in removal from the laboratory and assignment of a grade of zero. Be certain to handle and dispose of all chemicals safely (ASK if you are unsure). Students who are not prepared for lab are a hazard to themselves and others. You will be expected to know and follow all rules outlined in the safety handout.

Laboratory Schedule – Labs technically begin Wed June 27th or Thur June 28th, however, you will not be reporting to the scheduled lab session until the week of July 9th.

<table>
<thead>
<tr>
<th>Session</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/27 6/28</td>
<td>Safety Quiz (D2L)</td>
</tr>
<tr>
<td>7/2 7/3</td>
<td>Nomenclature I and II (D2L)</td>
</tr>
<tr>
<td>7/4 7/5</td>
<td>No Labs</td>
</tr>
<tr>
<td>7/9 7/10</td>
<td>Safety (handout) and Molar Mass of a Volatile Liquid</td>
</tr>
<tr>
<td>7/11 7/12</td>
<td>Freezing Point Depression</td>
</tr>
<tr>
<td>7/16 7/17</td>
<td>Rate and Order of a Reaction</td>
</tr>
<tr>
<td>7/18 7/19</td>
<td>Rate and Activation Energy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week of</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/23 7/24</td>
<td>Determination of K</td>
</tr>
<tr>
<td>7/25 7/26</td>
<td>Buffers</td>
</tr>
<tr>
<td>7/30 7/31</td>
<td>Determination of Ksp</td>
</tr>
<tr>
<td>8/1 8/2</td>
<td>Hess’s Law</td>
</tr>
<tr>
<td>8/6 8/7</td>
<td>Electrochemistry</td>
</tr>
<tr>
<td>8/8 8/9</td>
<td>Copper and Zinc Lab</td>
</tr>
<tr>
<td>8/13 8/14</td>
<td>Lab Practical</td>
</tr>
</tbody>
</table>

Examinations

Three 1-hour exams are scheduled by the university throughout the summer session on Fridays starting at 11:00AM. The final examination will be given on Friday August 18th starting at 11:00AM.

<table>
<thead>
<tr>
<th>Exam</th>
<th>Date</th>
<th>Time</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour Exam #1</td>
<td>July 6th 2018</td>
<td>11:00 AM</td>
<td>CHM 180</td>
</tr>
<tr>
<td>Hour Exam #2</td>
<td>July 20th 2018</td>
<td>11:00 AM</td>
<td>CHM 180</td>
</tr>
<tr>
<td>Hour Exam #3</td>
<td>August 3rd 2018</td>
<td>11:00 AM</td>
<td>CHM 180</td>
</tr>
<tr>
<td>Final Examination</td>
<td>August 17th 2018</td>
<td>11:00 AM</td>
<td>CHM 180</td>
</tr>
</tbody>
</table>

You will be allowed to drop your lowest hour exam score. There will be no early exams, no late exams, and no make-up exams. The only exceptions to this are verified military activities, verified student disability (ARC VISA variable attendance accommodation), religious observance verification (following university policy). The final exam is mandatory.
One standardized final examinations will be used in this course. This final examination covers BOTH General Chemistry I AND General Chemistry II information.

In order to be eligible to pass the course, you must score in the 35th percentile or higher on the standardized final examination.

If you do not take the final exam, you cannot pass the course.

Academic Dishonesty

Cheating on an examination, quiz, lab report or other graded material will result in a grade of zero as a minimum consequence. Failure in the course and referral to the Dean may also occur. Academic dishonesty or misconduct in any form will not be tolerated. This includes the use of unauthorized materials during a quiz or exam – such as graphing calculators, etc.

Grading

Your final grade in the course is determined by adding up the total points earned from the following grade categories: Top two Hourly Exams, Final Exam score, quiz total, homework total, discussion total, Lab total and any extra credit earned. The total of these grade categories is divided 800 (the total number of points for the course). Your percentage is then compared to the grade table on the next page. Students are only given the grade that they have earned in the course.

The total number of points for the class is 800. A general breakdown by letter grade is shown on the next page but may be altered as needed. Breakdown of the 800 points is as follows:

Exams: Each one-hour exam is worth 100 points; for a total of 200 (dropping the lowest score).

Final Exam: The final exam is comprised of single test covering BOTH General Chemistry I AND General Chemistry II information for a total of 200 points. You must score in the 35th percentile or higher on the standardized final examination.

Quizzes: Each quiz will be worth 20 points and some may include extra credit. The six highest quiz grades (out of 8 possible) will contribute 100 points (normalized from 120 to 100) towards your final grade.

Attendance: 20 points will be awarded based on attendance. A students percent attendance will be used to calculate the points earned.

Discussion: Discussion sections points will be accumulated from attending discussion and completing the supplemental problems. These will be graded and will count 100 points towards your final grade.

Homework: Homework will be assigned from the lecture activities, course manual, and textbook. This will be due in discussion quarterly throughout the summer (After exam 1, 2, and
three). The final assignment will be due in lecture on the last day of lecture. These will be graded and will count 50 points towards your final grade.

**Laboratory:**
Laboratory will be worth 150 points. A failing grade (<60%) in laboratory will result in a failing grade for the class. The lab practical will count as two labs and is INCLUDED in your final lab grade. The two lowest lab scores will be dropped. The lab practical score cannot be dropped.

<table>
<thead>
<tr>
<th>Grade category</th>
<th>Points</th>
<th>Percentage</th>
<th>Letter grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour Exams</td>
<td>200</td>
<td>92.5-100</td>
<td>A</td>
</tr>
<tr>
<td>Final examination</td>
<td>200</td>
<td>89.5-92.4</td>
<td>A-</td>
</tr>
<tr>
<td>Quizzes</td>
<td>100</td>
<td>86.5-89.4</td>
<td>B+</td>
</tr>
<tr>
<td>Discussion</td>
<td>100</td>
<td>82.5-86.4</td>
<td>B</td>
</tr>
<tr>
<td>Homework</td>
<td>50</td>
<td>79.5-82.4</td>
<td>B-</td>
</tr>
<tr>
<td>Laboratory</td>
<td>150</td>
<td>76.5-79.4</td>
<td>C+</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>800</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Percentage** | **Letter grade**
----------------|----------------
72.5-76.4        | C              |
69.5-72.4        | C-             |
66.5-69.4        | D+             |
62.5-66.4        | D              |
59.5-62.4        | D-             |
Below 59.5       | F              |

**Department of Chemistry Policies**

Departmental policies regulating the conduct of this course can be found in the main office of the Chemistry Building (CHM 144). University policies can be found at [http://www.uwm.edu/Dept/SecU/SyllabusLinks.pdf](http://www.uwm.edu/Dept/SecU/SyllabusLinks.pdf)

**Select University Policies:** Below are links to a few select University policies

Accommodation of Religious Beliefs: [https://www4.uwm.edu/secu/docs/other/S1.5.htm](https://www4.uwm.edu/secu/docs/other/S1.5.htm)

Final Exam Policy: [http://www4.uwm.edu/secu/docs/other/S22.htm](http://www4.uwm.edu/secu/docs/other/S22.htm)

Register’s Office Policies: [http://uwm.edu/registrar/students/enrollment-policies/](http://uwm.edu/registrar/students/enrollment-policies/)

Active Duty Policy: [http://www4.uwm.edu/academics/military.cfm](http://www4.uwm.edu/academics/military.cfm)

**Tentative Class Schedule (subject to change)**

<table>
<thead>
<tr>
<th>Week of</th>
<th>Lecture Topics / Lab / Moodle</th>
<th>Exams and Quizzes</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 25th</td>
<td>Syllabus; Overview of the course and keys for success</td>
<td>Quiz 1</td>
</tr>
<tr>
<td></td>
<td>Chapter 12 (review) &amp; Chapter 13</td>
<td></td>
</tr>
</tbody>
</table>
Lab: Safety Quiz

<table>
<thead>
<tr>
<th>Date</th>
<th>Chapter(s)</th>
<th>Labs</th>
<th>Exam(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 2nd</td>
<td>Chapter 13 &amp; Chapter 14</td>
<td>Quiz 2&lt;br&gt;Exam 1, July 6th</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Lab</strong>: Nomenclature Quiz D2L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| July 9th   | Chapter 14 & Chapter 15                         | **M/T Lab**: MM of a volatile liquid  
**W/R Lab**: FP Depression  
**Homework 1 due 7/9 // 7/10 in discussion** | Quiz 3                     |
| July 16th  | Chapter 15 & Chapter 16                         | **M/T Lab**: Rate and Order  
**W/R Lab**: Rate and Activation Energy                             | Quiz 4<br>Exam 2, July 20th |
| July 23rd  | Chapters 16 & Chapter 17                        | **M/T Lab**: Determination of K  
**W/R Lab**: Buffers                                                      | Quiz 5                     |
|            | **Homework 2 due 7/23 // 7/24 in discussion**   |                                                                    |                            |
| July 30th  | Chapter 17 & Chapter 6 (review)                 | **M/T Lab**: Ksp  
**W/R Lab**: Hess’s Law                                                   | Quiz 6<br>Exam 3, Aug 3rd  |
| Aug 6th    | Chapter 18 & Chapter 19                         | **M/T Lab**: Copper and Zinc Lab  
**W/R Lab**: Electrochemistry                                                | Quiz 7                     |
|            | **Homework 3 due 8/6 // 8/7 in discussion**     |                                                                    |                            |
| Aug 13th   | Chapter 19                                      | **M/T Lab**: Lab Practicals  
**Homework 4 due 8/16 in lecture**                                        | Quiz 8<br>Final Exam, Aug 17th |

Learning Objectives

**GER outcomes:** GER courses provide “students with a broad body of knowledge” (UWM Fac. Doc. 1382, p. 2, II, par 1). This course carries the GER natural sciences distribution designation because it prepares students to achieve the following three learning outcomes. Upon successful completion of this course, you should be able to:

1. Understand and apply the major concepts of a natural science discipline, providing insights into its breadth and its relationship to other disciplines;
2. explain and illustrate the relationships between experiments, models, theories and laws; and,
3. demonstrate an understanding of the process of generating and testing of data, and apply this knowledge to the solution of problems.

**Course-specific objectives:** In order to set the GER outcomes within the framework of this course, a set of objectives have been designed to give you a better understanding of what you are expected to learn over the course of the semester, and some indication of how it will be measured as to what
degree this has occurred. These will be incorporated through all types of assessments but will be formally measured on the weekly quizzes and hourly exams. In order to prepare for this, certain objectives will be presented each week in discussion with exercises for practice.

The examples of how these may be measured are examples ONLY and should not be interpreted as an inclusive ‘checklist’.

Objective 1: Understand spatial scale, particularly to the very sizes (on the order of atoms).

As an example you should be able to: estimate measurement, conceptualize relative sizes, use measurement tools skillfully, correctly compare numbers, convert measurements and scales, be able to compare specific objects (atoms and molecules, for example) by size and use the atom as a starting point in representing matter and changes.

Objective 2: Understand the language of chemistry including naming simple compounds.

As an example you should be able to: properly define important key terms, give a name for a chemical formula of a simple compound, give the chemical formula for a name, give the charges and names for the monoatomic and polyatomic ions of interest (these will be specified).

Objective 3: Understand the relationship between macroscopic, particle and symbolic representations of matter including atom relationships in molecules and compounds.

As an example you should be able to: identify macroscopic vs particle representations, read chemical formula, represent bonding detail in molecules, know that some elements exist as diatomic molecules, and be able to interpret organic chemical formulas from line drawings.

Objective 4: Understand the relationship between the composition of atoms and their properties.

As an example you should be able to: identify the number of protons, neutrons, and electrons for any isotope or ion, approximate the relative abundance of certain isotopes given the periodic table and additional information (for example, the number of isotopes and the number of neutrons in each), and calculate weighted averages, isotopic masses or relative abundances.

Objective 5: Understand the basics of chemical reactions.

As an example you should be able to: balance chemical equations, correctly use terms and states of matter and correctly represent chemical formula.
Objective 6: Understand the basics of mixtures and chemical reactions involving water as a solvent.

As an example you should be able to: define key terms of mixtures, represent solutions on a macroscopic and particle-level and quantitatively represent concentrations.

Objective 7: Understand quantitative relationships between substances represented in a balanced chemical equation.

As an example you should be able to: do stoichiometric calculations involving moles, masses, volumes, pressures, particles, and concentrations of reactants and/or products also including limited quantities of a reactant.

Objective 8: Understand the properties and behavior of gases on both the macroscopic and particle level.

As an example you should be able to: relate pressure, volume, temperature and amount of an ideal gas, explain the ideal gas law in terms of gas particles, and calculate properties of a mixture of gases.

Objective 9: Understand the role of energy in a chemical reaction, particularly heat.

As an example you should be able to: define key terms including heat, work, and energy, identify key components of the first law of thermodynamics, calculate heat, heat capacity and specific heat, calculate change in enthalpy for a reaction by Hess’s law, and interpret an energy diagram.

Objective 10: Understand the basics of quantum mechanics as it applies to assigning quantum numbers to electrons in atomic orbitals as well as writing electron configurations.

As an example you should be able to: define key terms, know the rules for assigning quantum numbers, know the general rules for relative energy of atomic orbitals, apply Hund’s rule and determine paramaticity of elements in the ground state.

Objective 11: Understand periodicity of certain properties of the elements.

As an example you should be able to: define key terms, give periodic trends for certain properties, and give general descriptive chemistry facts.

Objective 12: Understand chemical bonding and molecular shape.

As an example you should be able to: be able to draw a Lewis dot structure, determine a molecular shape from VSEPR theory, determine molecular polarity and determine bond order.
Objective 13: Understand that breaking chemical bonds is an endothermic process.

As an example you should be able to: be able to correctly identify both an energy diagram and thermochemical equation showing the endothermic process of breaking a chemical bond.

Objective 14: Understand properties of liquids and solids.

As an example you should be able to: define key terms, correlate properties of liquids, interpret a phase diagram, identify differences between types of solids, and calculate properties of elemental cubic crystals.

Objective 15: Understand the experimental nature of science.

As an example you should be able to: define all components of the scientific method, identify key experiments and the conclusions made (particularly in atomic and electronic theory), conduct simple experiments in laboratory, use measurement tools accurately, and read equipment to the correct number of significant figures and maintain the correct number of significant figures throughout the calculations.

Objective 16: Understand how reactions take place over time.

As an example you should be able to: define key terms in kinetics, express the rate of reaction by change in concentration over time, graphically depict change of reaction rates over time, use initial rates to determine reaction order and rate constants, write and derive a rate law, graphically determine the relationship between concentration and time for different reaction orders, write and use integrated rate laws, graphically depict activation energy, calculate activation energy using experimental data, write an overall reaction and rate law given a mechanism, and identify a catalyst and intermediate.

Objective 17: Understand the basic principles of equilibrium.

As an example you should be able to: define key terms in equilibrium, write an equilibrium constant, describe equilibrium in terms of reaction rates, express the difference in large and small equilibrium constants, express equilibrium constants of gases in concentration and partial pressure, convert between these constants, use reaction quotients to determine reaction direction, calculate equilibrium constants and changes in concentrations, express the effect on equilibrium by changing system conditions.

Objective 18: Understand equilibrium of aqueous systems.

As an example you should be able to: define key term in acid/base and solubility equilibria, represent and calculate concentrations of acids or bases in water, represent and calculate concentrations when acids and bases react in water, calculate pH and pOH, order and calculate relative strengths of acids, bases and salts, represent non-aqueous systems
of acids and bases, interpret titration curves, represent and calculate concentrations of ionic species in a saturated solution, use equilibrium values to qualitatively analysis a mixture of ionic species.

**Objective 19: Understand the role of energy in a chemical reaction and how this applies to spontaneity of a reaction (integrating Objective 9).**

As an example you should be able to: define key terms in thermodynamics, represent entropy changes for simple systems, integrate enthalpy and entropy for a system and surroundings, identify key components of the second and third laws of thermodynamics, calculate changes in entropy, enthalpy and Gibbs free energy for a system and integrate spontaneity and equilibrium with thermodynamic calculations and estimations.

**Objective 20: Understand reactions involving the transfer of electrons.**

As an example you should be able to: define key terms in electrochemistry, balance redox reactions, represent electrochemical cells including cell diagrams, calculate standard cell potentials given standard reduction potentials under both standard and non-standard conditions (Nernst equation), integrate thermodynamics and equilibrium and identify differences between spontaneous (batteries) and nonspontaneous (electrolysis) processes.

In order to measure the degree to which students in this course meet the objectives for this course, the university criterion of understanding and applying the major concepts of a natural science discipline, including its breadth and its relationship to other disciplines will be measured using the final course exam. This final exam will be graded based on correctness of responses and, where appropriate, as supported by student work in problem solving.

**UW System Shared Learning Goal:** This course also meets shared UW System Shared Learning Goal 2: “Critical and Creative Thinking Skills including inquiry, problem solving, and higher order qualitative and quantitative reasoning.” This is met through the course objectives as described previously.

**Time Spent on the Course**

To estimate the time that a student should expect to spend on this course, one can use the standard method of a minimum of 3 hours outside of class for every hour in class. Therefore for a 5 credit course (counting laboratory as only one hour), a student may expect to spend a minimum of 15 hours per week on the course outside of class. Being an accelerated summer course, in actuality you should expect to spend 30 hours per week on the course outside of class. This includes studying, reading, doing homework, writing laboratory reports and rewriting class notes.
Some Notes of Studying

Learning in this class may come with hard work and dedication. Please remember that much of your learning takes place through your own reading of the textbook, reading of your lecture notes, working problems, and conversations with me, your TA, and your classmates. Please do not expect to learn all of the concepts by attending lecture only. Your teaching team (me, your discussion TA, and your laboratory TA) will work cohesively to present you with learning opportunities. To best use these opportunities, please come prepared. Otherwise much of what is discussed may be confusing or frustrating. I am hopeful that by the end of the semester, you will find that learning chemistry is exciting and rewarding.

Here are some tips for success in Chemistry 104:

1. Read the text (on the lecture material for the day) before attending the lecture.

2. Attend lecture, discussion and laboratory sessions. Take these times seriously. Be on time, stay attentive and take notes.

3. Use your lecture notes – how may be very individual to you. This could include recopying or rereading after lecture (the closer to the lecture the better), adding to lecture notes from textbook material, adding problems, or discussing within a study group. Your lecture notes should be considered another source of information for this course (like your textbook).

4. Do as many problems as you are able – more than those assigned. You will probably have to average 6 - 8 problems a day, seven days a week to be successful in the course. Don’t wait until right before the exam – you will most likely be overwhelmed and unable to properly understand the material. If you have difficulty solving a particular problem, go back to the more straightforward related problems in the text and work them first. Indeed, one of the main purposes of this course is to help you develop your own method of thinking through problems. See your homework as an opportunity to test yourself on your own learning – this will allow you to find where you have succeeded in understanding and where you may still need to work through some concepts. Please do not wait until a quiz or exam to test your learning. See me if you would like help with ways to check your learning.

5. Form a study group or attend the group tutoring sessions – these can be a very effective method of learning.

6. Strive for understanding instead of just familiarity. It may take several attempts to gain the level of understanding that will allow you to articulate and use the models presented in this course. Be patient with yourself!

7. Be proactive! If you are struggling to understand something – seek help. Chemistry builds on previous concepts – without fully understanding one concept, it is very difficult to understand the next concept on which it builds.

I hope your experience this semester will be a rewarding one.