CHEM 215

General Chemistry II: Quantitative Applications of Chemistry Concepts

Fall 2012

(The instructor reserves the right to make changes to the syllabus if necessary. All changes will be posted on the CHEM 390 iLearn site. This version updated 27aug2012.)

<table>
<thead>
<tr>
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<tbody>
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<tr>
<td>Office Hours</td>
<td>Tues 1:10–2:00, Thur 2:10–3:00, Fri 11:10–12:00</td>
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Course Description and Learning Objectives

The focus of CHEM 215 is on the quantitative applications of general chemistry concepts. Students re-examine, in a quantitative fashion, fundamentally important chemistry concepts that were introduced in CHEM 115, learn new chemistry concepts, and apply the four themes developed in CHEM 115 (properties of atoms, interactions of atoms, reaction chemistry and stoichiometry, and chemical dynamics) to quantitative chemistry problems. The course explores the following topics: Electromagnetic radiation, atomic spectra, quantum-mechanical model of the atom; coordination chemistry and Lewis acid-base theory; electrochemistry; chemical kinetics; chemical equilibrium, especially of aqueous solutions; Bronsted-Lowry acid-base chemistry and equilibrium; chemical dynamics, including the thermodynamics of phase changes; properties of solids, liquids, and gases, including vapor pressure; stoichiometry; and nuclear chemistry. A detailed list of CHEM 215 course objectives and learning outcomes is provided below.

Lecture Information

CHEM 215 will be taught using an “inverted classroom” approach. In this approach materials that would normally be presented in class lectures will be available online, and class time will be spent in discussion, demonstration, collaboration, problem solving, and other activities. Pre-recorded lectures will be posted on iLearn for students to view in place of traditional lectures. Students are expected to view the lectures and textbook reading assignments, and complete some OWL homework problems, before coming to class. Students will use i-clickers in class to respond to conceptual and quantitative questions, and earn credit for their responses. Class participation is important. Questions and comments from students during class are welcomed, expected, and encouraged.

The daily lecture schedule is available as a separate document on iLearn. The textbook will not be followed in a linear fashion, so students should be sure to follow the lecture schedule. The lecture schedule is subject to change during the semester, depending on the pace of the class; changes will be posted on iLearn. Lectures begin at 9:35 a.m. and end at 10:50 a.m. Please silence cell phones during class.
Course Prerequisites and Structure
To enroll in CHEM 215, students must have earned a C or better grade in CHEM 115 and earned a C- or better grade in PHYS 111 and either MATH 226 or PHYS 121.

CHEM 215 is a three-unit lecture course. Enrollment in its complementary laboratory course, CHEM 216, is recommended but optional. (Enrollment in CHEM 216 requires a C or better grade in CHEM 215 or concurrent enrollment in CHEM 215.)

Grading Policy
There are 1000 grade points possible for the course: 150 points for assigned OWL homework (due weekly; mastery grading; no extensions), 150 points for responses to in-class clicker questions, 48 points for reflection writing (8 assignments); 150 points each for three midterm exams (02 Oct, 06 Nov, and 04 Dec), and 252 points for the final exam (18 Dec). The total points earned determine the course grade as follows: A, 1000 – 871; A-, 870 – 810; B+, 809 – 760; B, 759 – 710; B-, 709 – 660; C+, 659 – 600; C, 599 – 550; C-, 549 – 500; D+, 499 – 440; D, 439 – 390; D-, 389 – 330; F, < 330.

OWL Homework Assignments
Mandatory, graded homework assignments will be due on a weekly basis, using Cengage’s OWL system. Each student’s score is determined by dividing the number of completed assignments by the number of assigned assignments, and then multiplying by 150. The first assignment will be due 8 a.m. on 13 Sept. Subsequent homework assignments will be due 8 a.m. on Thursdays. Homework assignments will be made at least two weeks in advance of their due-dates, and students can start working on assignments as soon as they are made available. No assigned assignments will be dropped from the grade calculation. Extensions will be made if the OWL website has significant technical problems.

Requests for individual extensions must be made through the OWL system and will be granted only for extraordinary circumstances. It is the student’s responsibility to look over the length and scope of the assignments at least two weeks before they are due and budget his/her time accordingly. It is the student’s responsibility to start the assignment well in advance of the deadline to have time to compensate for computer and/or server problems either on the OWL website or locally. Only the assignments marked as required will be used to determine the OWL grade; optional modules are not used for extra credit.

In-class Personal Response System (i>clicker2)
Students are required to bring an i>clicker2 remote to every lecture period for in-class participation. The i>clicker2 system uses wireless transmitters (“clickers”) to allow students to answer questions that the instructor pose during lectures. Students are graded on participation and on correct/incorrect responses. In order to receive credit for responses, the i>clicker2 remote must be registered in a student’s iLearn profile by 27 Sept. A student must have come to class at least once and voted on at least one question, in order to complete this registration properly. The remote ID is the series of numbers and sometimes letters (only letters A through F are used) found on the bottom of the back of the i>clicker2 remote. The i>clicker2 response system will be used every day in class, and students are responsible to bring the remote to every class.

The clicker questions will help keep students engaged on the material during class, provide students with immediate feedback on their understanding, help them learn strategies to answer multiple-choice questions, and allow class time to be best used to address misconceptions. It is
expected, and strongly encouraged, that students will discuss the questions and answers with classmates before submitting responses. The following policies apply to the i>clicker system:

1) For most questions, a correct response is awarded one point, an incorrect response is awarded one-half point, and no response is awarded zero credit. For some questions, one point will be awarded for any response and no response will be awarded zero credit.

2) There will be about 25 classes with clicker questions, beginning on 04 Sept. Each student’s score is determined by dividing his or her total clicker points by a number equal to 80% of the possible score, and then multiplying by 150. If this calculation results in a score greater than 150, the student’s score is reduced to 150 points.

3) To receive credit, a student must be present in class and send his or her response to a question before the time expires. Under no circumstances, including technical problems with a clicker, are make-ups allowed for clicker questions. It is each student’s responsibility to register his or her clicker as instructed. It is also each student’s responsibility to review his or her clicker scores iLearn account to make sure the responses are being recorded and credit is being awarded.

4) Students who buy used clickers should be prepared to replace the batteries.

5) Instructions for clicker registration will be given in the class, and posted on the CHEM 215 iLearn site.

6) Clicker responses are the personal work of each student. Submitting a response for another student or allowing another student to submit a response is considered cheating. All students involved in such activity will receive zero clicker credit for the semester and will be reported to the Student Discipline Officer.

Reflection Writing
To turn knowledge into something than can be used, it is important to reflect on what you know and what issues are still confusing to you. Students will be required to submit eight reflections via iLearn. Each reflection assignment will be posted on iLearn at least one week before its due date. The assignment will include prompts for you to write about or respond to. You should spend approximately 30 minutes considering the prompt and responding in writing. These reflections are not meant to be formal essays, or finely polished documents for public view. They should show the student’s own ideas and thought processes, and should be as much for his or her own benefit as the instructor’s. Each reflection should be 150-200 words and address the question(s) or prompt(s) for the unit. Each reflection assignment is graded on a 6-point scale. Late submissions are accepted up to 48 hours after the due date, and will receive a maximum of half credit (3 points).

Reflections are intended as a learning tool to provide students with a regular opportunity to reflect on what they understand, what they find confusing, and what they are learning in class. Reflection writing assignments are announced in class and the prompts are posted on iLearn one week before the assignment is due. Students submit their written response electronically on iLearn, using a Reflection assignment textbox.

For each Reflection, students should prepare an electronic document that includes:

1) Name and SFSU ID number
2) The date the Reflection is due
3) The actual text of the question or prompt (given in class or on iLearn)
4) Numerical values, when requested, and a 150-200 word written response reflecting his or her own ideas on the topic, in complete sentences.
Students then copy and paste this information into an online assignment textbox on iLearn.

**How much time should be spent writing?**

Students should spend approximately 30-40 minutes on each reflection response. As you prepare for your professional career, learning to write down your ideas and clarify your thoughts is a key to success. Reflecting on what you are learning is essential for processing new experiences and ideas and storing new information in long-term memory. If you find this writing time particularly useful, please feel free to spend more time.

**Who will read my Reflections?**

The course instructor will be the primary reader of your reflections. Your candor and willingness to write your honest thoughts is appreciated. If excerpts from reflection entries are shared in class, they will be edited as necessary to appear anonymous. If there is anything that you write in your reflection that you specifically do not want to be shared anonymously in class, just indicate that in your submission.

**How will my Reflection entries be graded?**

1. Some prompts include questions for which there will be correct and incorrect responses, but most questions do not have “right” or “wrong” answers.
2. Reflections are graded on effort and participation.
3. Each reflection assignment is worth 6 points: up to 3 points for submitting a response that is 150-200 words and addresses the question/prompt(s), and up to 3 points for clarity, thoughtfulness and depth of the response.
4. Late reflection entries will be accepted up to 48 hours after the due date.
5. Late reflection entries will earn a maximum of half credit (3 points).

The reflection assignment was designed by SF State’s Science Education Partnership & Assessment Laboratory, and these instructions are adapted from the BIOL 230 Reflection instructions.

**Midterm and Final Exams**

The exams will use multiple-choice questions and word problems to assess both conceptual understanding and quantitative application of the chemistry topics covered in the course. About half of the midterm exam content will be drawn directly from OWL assignments and suggested textbook problems. A periodic table, list of abbreviations, and physical constants are included with all exams. Equations are not provided; students are responsible for all equations needed to solve the assigned OWL assignments and problems discussed in class. No work needs to be shown for multiple-choice questions. Answers to numerical problems must show all steps necessary to reach the answer; no credit will be given for simple numerical answers. Explanations to questions must be written in complete English sentences. Poor expression will result in loss of credit. A No. 2 pencil, Scantron form 882-ES or equivalent, and a “green book” are required for each exam. A calculator is allowed and highly recommended. No other electronic device of any sort is allowed, including cell phones with calculator programs and programmable calculators. Exams are closed-book and no notes are allowed.

**Additional Homework – Self-Study Problems and Old Exams**

Additional homework problems will be assigned from the textbook, but they will not be collected or graded. They are provided to allow students to assess their understanding of the material and to review for exams. These self-study problems will be posted on the iLearn website as the semester progresses. Some CHEM 215 midterm exams from prior semesters will be available on iLearn. Studying only previous-semester exams will not prepare students for the midterms. This is because
the exams do not include questions for every topic covered, the lecture schedule changes, and different topics may be emphasized each semester. Answer keys are not provided for these exams.

**Exam results, answer keys, exam re-grading policies**

Exam results and midterm answer keys will be posted on iLearn as soon as possible; usually this will occur within one week of the exam. Midterm exams are returned in accordance with Family Educational Rights and Privacy Act (FERPA) requirements and each student’s instruction: They can be held for pick-up during office hours or, if the student has waived his or her FERPA rights, they can be picked up from a pile of graded exams made available at the beginning of a CHEM 215 class meeting. All students will be able to look through the pile of exams to find their own exams. The final exam will be available for review after the end of the semester; it is not returned.

Requests to re-grade an exam must be made in writing and submitted, with the Scantron form and blue book, within one week of the when the exams were returned to students. “Returned” means the day that the exams were made available for pick-up in class, regardless of a student’s exam-return instruction and the actual date of receiving her or his exam.

**Attendance Policy**

Student participation in the in-class personal response questions (“clicker questions”) is recorded and contributes to the course grade. Students are not dropped from the class for non-attendance; it is the student’s responsibility to drop the class if he or she no longer wants to remain enrolled.

Students are expected to participate in class and to keep up with the material as it is discussed in class. Pre-recorded lectures should be viewed and textbook readings should be completed before class, as should any OWL optional assignments necessary to refresh concepts covered in CHEM 115.

In general, make–up exams are not given. However, exceptions may be made in extraordinary situations with written, verified, and legitimate causes.

**Students with Disabilities**

Students with disabilities who need reasonable accommodations are encouraged to contact the instructor. The Disability Programs and Resource Center (DPRC) is available to facilitate the reasonable accommodations process. The DPRC is located in the Student Service Building and can be reached by telephone (voice/TTY 415-338-2472) or by email (dprc@sfsu.edu). General information about the DPRC is available at [http://www.sfsu.edu/~dprc/](http://www.sfsu.edu/~dprc/).

**Department of Chemistry & Biochemistry Policies**

To take a chemistry course that lists CHEM 215 as a prerequisite, a grade of C or better in CHEM 215 is required.

**Time Commitment**

SF State’s definition of the semester unit includes the statement, “At least two hours of study is expected in preparation for each hour of class.” Thus, for a 3-unit lecture course, the expectation is that students spend a minimum of 9 hours per week on the course. This includes attending lecture, doing the reading and homework assignments, other studying for the course and attending office hours or tutor hours. Very few students who spend just 9 hours per week on CHEM 215 do well. Many students will require at least 15 hours per week to be successful in CHEM 215.
Preparing for Lecture and Assistance
Break this course down into little blocks. For each class meeting, view the pre-recorded lecture, read the section of the text that will be discussed in lecture, and do OWL homework problems assigned for that topic. Write down any questions on the material for lecture or office hours. Participate in class, and take notes. After class, review the lecture notes and add any details that come to mind. Review the questions from the reading to see if the class activities answered them. Get your questions answered: attend office hours; make an appointment to see a tutor in the Learning Assistance Center (HSS 348, lac@sfsu.edu, 415 338 1993); send an e-mail with a succinct question to the instructor; work with other students. If the instructor’s office hours are inconvenient for you, please try to set up an appointment for another mutually beneficial time.

The Community Access and Retention Program (CARP) offers tutorial and other academic support services tailored to student learning needs, particularly students who are underrepresented, first generation college students, and/or are impacted by Executive Order 665. Location: HSS 344; Phone: 415.405.0316 for information; 415.405.0971 for appointments; e-mail: carp1@sfsu.edu.

SCI 215, a student-centered discussion and problem-solving supplemental instruction course is designed to promote understanding of key concepts and enhance student success in CHEM 215. SCI 215-01 meets 1100-1215 on Tuesdays in Trailer P room 3.

Academic Honesty
All work submitted by the student must be his or her own work. The Department of Chemistry & Biochemistry’s Policy on Academic Cheating and Plagiarism for Students (www.chembiochem.sfsu.edu/cheating_plagiarism/cheating_plagiarism_current.pdf) apply to this course. Any incidents of cheating will reported to the Student Discipline Officer and no credit will be given for that assignment. A set of plagiarism resources, developed by SF State’s College of Humanities, can be used to learn about plagiarism (http://www.sfsu.edu/~collhum/plagiarism.html). They define plagiarism as, “Plagiarism is a form of cheating or fraud; it occurs when a student misrepresents the work of another as his or her own. Plagiarism may consist of using the ideas, sentences, paragraphs, or the whole text of another without appropriate acknowledgment, but it also includes employing or allowing another person to write or substantially alter work that a student then submits as his or her own.” Computers and the Internet have made plagiarism very easy—copy and paste commands have become ubiquitous—but it’s still dishonest, illegal, immoral, and will not be tolerated. The Son of Citation Machine website (http://citationmachine.net/) can help you properly credit information sources. All work submitted for evaluation in the lecture must be the student’s own work. Zero credit will be given for work that is believed to have resulted from cheating for all students involved. Any cheating incident will be reported to the Student Discipline Officer.

General Classroom Courtesy
By enrolling in the class, I am assuming that you are intent upon having the most productive learning experience. To ensure that you and your classmates have equally productive experiences, please:

- **Silence all cell phones, PDAs and anything else that may make disruptive noises.**
- **Stay focused on the lecture topic.** Discussion is expected during appropriate times, but please respect others and do not talk when the instructor is talking to the entire class.
- **Be on time.** I make my best efforts to be on time so that you get the class time you signed up for. I realize that your time is valuable and do my best to respect it. I would appreciate it if you would do the same. However, if you are unavoidably late, enter through the rear door.
• **Enter the classroom through the rear door if you’re late.** This will minimize the disruption of your classmates’ learning experience you may cause by entering through the front. Also, take the nearest seat you can. Excess motion/movement in the rear (which is visible from the front by the instructor) is disruptive as well.

**Course-related Correspondence**

Students’ official sfusu.edu e-mail addresses will be used for most correspondence: All iLearn communication is sent to students’ sfusu.edu e-mail addresses; OWL communication is sent to the e-mail address supplied by students in their OWL accounts. Students are responsible for all information sent to their sfusu.edu and OWL-account e-mail addresses. Instructions on forwarding sfusu.edu e-mail to another e-mail account are available at [http://www.sfsu.edu/~doit/account.htm#forward](http://www.sfsu.edu/~doit/account.htm#forward).

**Course Websites**

- General class website: [http://ilearn.sfsu.edu](http://ilearn.sfsu.edu) (CHEM 215 space. The course syllabus, lecture schedule, self-study problems from text, exam keys and other lecture materials are available on the iLearn site. Midterm and final exam scores will be posted there, as will the course grade calculation. Class announcements will be posted there, and any changes in the course syllabus or lecture schedule will be posted on iLearn. Announcements sent through iLearn go to your SFSU e-mail account. Be sure to read your SFSU e-mail or have it automatically forwarded to an account that you do read.

- OWL: User Login and Student Registration webpage: [https://owl.cengage.com/owlc/register/owlmgr.cgi?Mode=2&ArchivedDatabaseID=247&CategoryID=46](https://owl.cengage.com/owlc/register/owlmgr.cgi?Mode=2&ArchivedDatabaseID=247&CategoryID=46) Use this url for SF State’s registration and login webpages or navigate from the main website, [http://owl.cengage.com](http://owl.cengage.com), by first selecting “general chemistry” as your course, then “Chemistry, 9th Edition; Whitten, Davis, Peck, Stanley” as your book, then “San Francisco State University - San Francisco, California” as your institution. *(Note that you must select the Whitten et. al. textbook link; the OWL website does not have a link for Silberberg.)* An access code is required to register. After you have registered, you should bookmark the CHEM 215 login page to simplify future logins. This website is where graded homework assignments will be listed; all OWL homework is performed through this website and requires an Internet connection. OWL-related class announcements (e.g., changes in homework assignments) will also be posted and distributed from this website. Announcements sent through OWL go to the e-mail account you specify during OWL registration. Be sure to read that account.

**Course Materials**

**Textbook**


Two copies of the hardcover text are available in the J. Paul Leonard Library’s Reserve Book Room. They may be checked-out overnight, except over weekends.

Most students are continuing from CHEM 115 and should have a copy of *Silberberg 5th ed.* Students who are not able to get a copy of *Silberberg 5th ed.* are strongly encouraged to pursue one of the following options. Do not attempt to complete CHEM 215 without a textbook!

1) Obtain a copy of a different edition of Silberberg. CHEM 215 documents will reference the fifth edition, but almost any edition (second through sixth) could be used.

3) Obtain a copy of a general chemistry textbook. No correlation to CHEM 215 syllabus provided.


**OWL Online Homework Access**


**i>clicker Remote**

i>clicker remotes are available for purchase in the SFSU Bookstore. Information about registering the i>clicker will be provided in class and on the CHEM 215 iLearn site.

**Calculator**

An inexpensive non-programmable scientific calculator with logarithms, exponentials and scientific notation (e.g., TI-30XA, Casio FX-260 or Casio FX-300MS) is highly recommended. **Programmable calculators, such as TI graphing calculators, cannot be used during exams.**

**Detailed Course Objectives and Learning Outcomes**

Students will gain both a conceptual understanding of general chemistry topics and the ability to solve quantitative problems that require the application of general chemistry topics. The specific topics are: Electromagnetic radiation, atomic spectra, quantum-mechanical model of the atom; coordination chemistry; electrochemistry; chemical kinetics; chemical equilibrium; acid-base chemistry and acid-base equilibrium; thermodynamics, including the thermodynamics of phase changes; properties of solids, liquids, and gases, including vapor pressure; and nuclear chemistry. Below is a detailed list of the concepts and skills that students should know after successfully completing CHEM 215, arranged by lecture topic. These learning objectives listed are taken, with minor editing, from Silberberg, Martin S. Chemistry: The Molecular Nature of Matter and Change, 5th Edition, McGraw-Hill. Concepts and skills developed in CHEM 115 are marked with an asterisk [*].

**Electromagnetic radiation, atomic spectra, quantum-mechanical model of the atom:**

- Understand the wave characteristics of light (the interrelations of frequency, wavelength, and speed; the meaning of amplitude) and the general regions of the electromagnetic spectrum. [*]
- Understand how particles and waves differ in terms of the phenomena of refraction, diffraction, and interference.
- Understand the quantization of energy and the fact that an atom changes its energy by emitting or absorbing quanta of radiation. [*]
• Understand how the photon theory explains the photoelectric effect and the relation between photon absorbed and electron released. [*]
• Understand how Bohr’s theory explained the line spectra of the H atom, and the importance of discrete atomic energy levels. [*]
• Understand how electron density diagrams and radial probability distribution plots depict electron location within the atom. [*]
• Understand the distinction between energy level (shell), sublevel (subshell), and orbital. [*]
• Know the shapes and nodes of $s$, $p$, and $d$ orbitals.
• Be able to interconvert wavelength and frequency.
• Be able to calculate the energy of a photon from its wavelength.
• Be able to calculate the energy change and wavelength of the photon absorbed or emitted when a hydrogen atom’s electron changes energy level.

Coordination Chemistry:
• Know the positions of the $d$-block elements and the general forms of their atomic and ionic electron configurations. [*]
• Understand how atomic size, ionization energy, and electronegativity vary across a period and down a group of transition elements and how these trends differ from those of the main-group elements.
• Understand why the transition elements often have multiple oxidation states and why the 2+ state is common. [*]
• Understand why many transition metal compounds are colored and paramagnetic.
• Know the coordination numbers, geometries, and ligand structures of complex ions.
• Know how coordination compounds are named and their formulas written.
• Know how Werner correlated the properties and structures of coordination compounds.
• Understand how valence bond theory uses hybridization to account for the shapes of octahedral, square planar, and tetrahedral complexes. [tetrahedral complexes *]
• Understand how crystal field theory explains how approaching ligands cause $d$-orbital energies to split.
• Understand how the relative crystal-field strength of ligands affects the $d$-orbital splitting energy $\Theta$.
• Understand how the magnitude of $\Theta$ accounts for the energy of light absorbed and, thus, the color of a complex.
• Understand how the relative sizes of pairing energy and $\Theta$ determine the occupancy of $d$ orbitals and, thus, the magnetic properties of complexes.
• Understand the Lewis definitions of an acid and a base and how a Lewis acid-base reaction involves the donation and acceptance of an electron pair to form a covalent bond.
• Understand how metal cations act as Lewis acids.
• Be able to write electron configurations of transition metal atoms and ions. [*]
• Be able to use a partial orbital diagram to determine the number of unpaired electrons in a transition-metal atom or ion. [*]
• Be able to recognize the structural components of complex ions.
• Be able to name and write formulas of coordination compounds.
• Be able to correlate a complex ion’s shape with the number and type of hybrid orbitals of the central metal ion.
• Be able to use the spectrochemical series to rank complex ions in terms of $\Theta$ and the energy of light absorbed.
• Be able to identify Lewis acids and bases.
Electrochemistry:

• Understand the importance of net movement of electrons in the redox process. [*]
• Understand the relation between change in oxidation number and identity of oxidizing and
  reducing agents. [*]
• Understand the distinction between voltaic and electrolytic cells in terms of the signs of \( \Delta G \) and \( E \).
• Understand how voltaic cells use a spontaneous reaction to release electrical energy.
• Understand the physical makeup of a voltaic cell, including the arrangement and composition
  of half-cells, relative charges of electrodes, and the purpose of a salt bridge.
• Understand the physical makeup of an electrolysis cell, including the relative charges of
  electrodes.
• Understand the usefulness and significance of standard electrode reduction potentials.
• Understand how half-reaction potentials are used to calculate \( E^\circ \text{cell} \).
• Understand how the standard reference electrode is used to find an unknown half-reaction
  potential.
• Understand how the relative reactivity of a metal is determined by its reducing power and is
  related to its standard reduction potential.
• Understand how \( E_{\text{cell}} \) is related to \( \Delta G \) and the charge flowing through the cell.
• Understand the interrelationship of \( \Delta G^\circ, E^\circ_{\text{cell}}, \) and \( K \).
• Understand how \( E_{\text{cell}} \) changes as \( Q \) changes.
• Understand why a voltaic cell can do work until \( Q = K \).
• Understand how a concentration cell does work until the half-cell concentrations are equal.
• Understand the distinction between primary and secondary batteries.
• Understand the nature of fuel cells.
• Understand how corrosion occurs and can be prevented, and the similarities between a
  corroding metal and a voltaic cell.
• Understand how electrolytic cells use nonspontaneous redox reactions driven by an external
  source of electricity.
• Understand how atomic properties determine the products of the electrolysis of molten salt
  mixtures.
• Understand how the electrolysis of water influences the products of aqueous electrolysis and
  the importance of overvoltage.
• Understand the relationship between the quantity of charge flowing through a cell and the
  amount of reactant consumed or product formed.
• Be able to determine the oxidation number of any element in a compound.
• Be able to identify redox reactions.
• Be able to identify the oxidizing and reducing agents in a redox reaction.
• Be able to balance redox equations.
• Be able to use the half-reaction method to balance redox reactions in acidic or basic solution.
• Be able to diagram and identify the components in a voltaic cell.
• Be able to combine half-reaction potentials to obtain \( E^\circ_{\text{cell}} \).
• Be able to manipulate half-reactions to write a spontaneous redox reaction and calculate its \( E^\circ \)
  value.
• Be able to rank the relative strengths of oxidizing and reducing agents in a redox reaction.
• Be able to predict whether a metal can displace hydrogen or another metal from solution.
• Be able to use the interrelationship of \( \Delta G^\circ, E^\circ_{\text{cell}}, \) and \( K \) to calculate any two of the three given
  the third.
• Be able to use the Nernst equation to calculate E from $E^{\circ}_{\text{cell}}$ and Q.
• Be able to predict the products of the electrolysis of a mixture of molten salts or of aqueous salt solutions.
• Be able to calculate the current or time needed to produce a given amount of product by electrolysis.

**Kinetics:**
• Understand how reaction rates depend on concentration, physical state, and temperature. [*]
• Understand the meaning of “reaction rate” in terms of changing concentrations over time. [*]
• Understand how the rate can be expressed in terms of reactant or product concentrations. [*]
• Understand the distinction between average and instantaneous rate and why the instantaneous rate usually changes during a reaction. [*]
• Understand the experimental basis of the rate law and the information needed to determine the rate law. [*]
• Understand how integrated rate laws show the dependence of concentration on time.
• Understand what the term “reaction half-life” means and why it is constant for a first-order reaction.
• Understand the concept of activation energy and the effect of temperature on rate constants. [*]
• Understand how temperature affects reaction rates. [*]
• Understand why molecular orientation and complexity influence the number of effective collisions and the rate of reaction. [*]
• Understand the transition state theory of reactions. [*]
• Understand how an elementary step represents a single molecular event. [*]
• Understand how a reaction mechanism consists of several elementary steps, with the slowest step usually determining the observed rate. [*]
• Understand the criteria for validating a postulated reaction mechanism. [*]
• Understand how a catalyst increases the rate of reaction. [*]
• Understand the distinction between homogeneous and heterogeneous catalysis. [*]
• Be able to express reaction rate in terms of changes in concentration over time. [*]
• Be able to determine reaction order from a known rate law. [*]
• Be able to determine reaction order from changes in initial rate with concentration. [*]
• Be able to calculate the rate constant and its units from changes in initial rate with concentration.
• Be able to use an integrated rate law to find concentration at a given time or the time to reach a given concentration.
• Be able to determine reaction order graphically with a rearranged integrated rate law and experimental data.
• Be able to calculate the half-life of a reaction.
• Be able to use the Arrhenius equation to calculate the activation energy.
• Be able to use the Arrhenius equation to calculate a specific rate constant at different temperatures.
• Be able to use reaction energy diagrams to depict the energy changes during a reaction. [*]
• Be able to postulate a transition state for a simple reaction.
• Be able to determine the molecularity and rate law for an elementary step.
• Be able to construct a valid reaction mechanism with either a slow or a fast initial step.
• Be able to construct a valid reaction mechanism with a fast pre-equilibrium step.
• Be able to use the Maxwell–Boltzmann distribution equation to calculate the fraction of species with energy equal to or greater than $E_a$.

**Equilibrium:**
• Understand the distinction between the rate and the extent of a reaction. [*]
• Understand why a system attains dynamic equilibrium when forward and reverse reaction rates are equal. [*]
• Understand how the magnitude of $K$ is related to the extent of the reaction. [*]
• Understand the relationship between the numerical value of the equilibrium constant, a particular ratio of rate constants, and a partial ratio of concentration or pressure terms.
• Understand why the same equilibrium state is reached no matter what the starting concentrations of the reacting system. [*]
• Understand how the reaction quotient ($Q$) changes continuously until the system reaches equilibrium, at which point $Q = K$. [*]
• Understand why the form of $Q$ is based exactly on the balanced equation as written.
• Understand how the sum of reaction steps gives the overall reaction, and the product of $Q$’s (or $K$’s) gives the overall $Q$ (or $K$).
• Understand why pure solids and liquids do not appear in $Q$.
• Understand how the reaction direction depends on the relative values of $Q$ and $K$. [*]
• Understand how a reaction table is used to find an unknown concentration or pressure.
• Understand how assuming that the change in [reactant] is relatively small simplifies finding equilibrium quantities.
• Understand how Le Châtelier’s principle explains the effects of a change in concentration, pressure (volume), or temperature on a system at equilibrium and on $K$. [*]
• Understand why a change in temperature does affect $K$ but the addition of a catalyst does not affect $K$.
• Understand the molarity concentration unit and how to calculate a solute’s molarity. [*]
• Know how to write the reaction quotient and equilibrium constant expression for a balanced equation, a reaction consisting of more than one step, a reaction multiplied by a common factor, and a heterogeneous reaction.
• Be able to compare $Q$ and $K$ to determine reaction direction. [*]
• Be able to calculate a solute’s molarity. [*]
• Be able to use a reaction table to determine quantities and find $K$.
• Be able to find one equilibrium quantity from other equilibrium quantities and $K$.
• Be able to find an equilibrium quantity from initial quantities and $K$, often by assuming that the change in [reactant] is relatively small and checking that assumption.
• Be able to solve a quadratic equation for an unknown equilibrium quantity.
• Be able to compare the values of $Q$ and $K$ to find reaction direction and $x$, the unknown change in a quantity.
• Be able to compare the relative values of $Q$ and $K$ to predict the effect of a change in concentration on the equilibrium position and on $K$.
• Be able to use Le Châtelier’s principle and $\Delta n_{\text{gas}}$ to predict the effect of a change in pressure (resulting from a change in volume) on the equilibrium position.
• Be able to use the van’t Hoff equation to calculate $K$ at one temperature given $K$ at another temperature.

**Acid/Base Chemistry:**
• Understand the main distinction between strong and weak aqueous acids and bases. [*]
• Understand the essential character of aqueous acid-base reactions as proton-transfer processes. [*]
• Understand how to determine \([\text{H}_3\text{O}^+(aq)]\) and \([\text{OH}^-(aq)]\) in an aqueous acid solution. [*]
• Understand how to calculate an unknown concentration from an acid-base titration. [*]
• Understand how to determine \([\text{H}_3\text{O}^+(aq)]\) (or \([\text{OH}^-(aq)]\)).
• Understand how the important macroscopic properties of water arise from atomic and molecular properties. [*]
• Understand how to determine \([\text{H}_3\text{O}^+(aq)]\) (or \([\text{OH}^-(aq)]\)).
• Understand why all reactions of a strong acid and a strong base have the same \(\text{rxn}^\circ\).
• Understand why the proton is bonded to a water molecule, as \(\text{H}_3\text{O}^+\), in all aqueous acid-base systems.
• Understand why all reactions of a strong acid and a strong base have the same \(\text{rxn}^\circ\).
• Understand how relative acid strength is expressed by the acid-dissociation constant \(K_a\).
• Understand the meaning of \(K_a\) and \(pK_a\). [*]
• Understand why water is a very weak electrolyte and how its autoionization is expressed by \(K_w\). [*]
• Understand why \([\text{H}_3\text{O}^+(aq)]\) is inversely related to \([\text{OH}^-(aq)]\) in any aqueous solution. [*]
• Understand how the relative magnitudes of \([\text{H}_3\text{O}^+(aq)]\) and \([\text{OH}^-(aq)]\) define whether a solution is acidic, basic, or neutral. [*]
• Understand the Brønsted-Lowry definitions of an acid and a base and how an acid-base reaction can be viewed as a proton-transfer process. [*]
• Understand how water acts as a base (or as an acid) when an acid (or a base) dissolves in it. [*]
• Understand how a conjugate acid-base pair differs by one proton. [*]
• Understand how a Brønsted-Lowry acid-base reaction involves two conjugate acid-base pairs. [*]
• Understand why a stronger acid and base react (\(K_{\text{rxn}} > 1\)) to form a weaker base and acid.
• Understand how the percent dissociation of a weak acid increases as its concentration decreases.
• Understand how a polyprotic acid dissociates in two or more steps and why only the first step supplies significant \([\text{H}_3\text{O}^+(aq)]\).
• Understand how weak bases in water accept a proton rather than dissociate. [*]
• Understand the meaning of \(K_b\) and \(pK_b\). [*]
• Understand how ammonia, amines, and weak-acid anions act as weak bases in water.
• Understand why relative concentrations of \(\text{HA}\) and \(\text{A}^-\) determine the acidity or basicity of their solution.
• Understand the relationship of the \(K_a\) and \(K_b\) of a conjugate acid-base pair to \(K_w\).
• Understand the effects of electronegativity, bond polarity, and bond strength on acid strength.
• Understand why aqueous solutions of small, highly charged metal ions are acidic.
• Understand the various combinations of cations and anions that lead to acidic, basic, or neutral salt solutions.
• Be able to class compounds as strong and weak acids and bases from their formulas.
• Be able to use \(K_w\) to calculate \([\text{H}_3\text{O}^+(aq)]\) and \([\text{OH}^-(aq)]\) in an aqueous solution.
• Be able to use \(p\)-scales to express \([\text{H}_3\text{O}^+(aq)]\), \([\text{OH}^-(aq)]\), and \(K\).
• Be able to calculate \([\text{H}_3\text{O}^+(aq)]\), \([\text{OH}^-(aq)]\), \(p\text{H}\) and \(p\text{OH}\).
• Be able to identify conjugate acid-base pairs.
• Be able to use relative acid strengths to predict the net direction of an acid-base reaction.
• Be able to calculate \(K_a\) of a weak acid from \(p\text{H}\) and \([\text{HA}(aq)]_{\text{init}}\).
• Be able to calculate $[\text{H}_3\text{O}^+(\text{aq})]$ (and, thus, pH) from $K_a$ and $[\text{HA(aq)}]_{\text{init}}$.
• Be able to calculate the percent dissociation of a weak acid.
• Be able to calculate pH from $K_b$ and $[\text{B}]_{\text{init}}$.
• Be able to calculate $K_b$ of $\text{A}^-$ from the $K_a$ of $\text{HA}$ and $K_w$.
• Be able to calculate $[\text{OH}^-(\text{aq})]$ (and, thus, pH) from $K_b$ (or $K_a$ of $\text{B}$’s conjugate acid) and $[\text{B(aq)}]_{\text{init}}$.
• Be able to predict the relative acidity of a salt solution from the nature of the cation and anion.
• Be able to calculate the pH of aqueous buffer solutions before and after the addition of strong acid or base.
• Be able to calculate the pH of aqueous solutions during the titration of a strong acid with a strong base, a weak acid with a strong base, and a weak base with a strong acid.

**Thermodynamics:**
• Understand the distinction between a system and its surroundings. [*]
• Understand how energy is transferred to or from a system as heat and/or work. [*]
• Understand the relation among internal energy change, heat, and work.
• Understand the meaning of energy conservation. [*]
• Understand the meaning of a state function and why $\Delta E$ is constant even though $q$ and $w$ vary.
• Understand the meaning of enthalpy and the relation between $E$ and $H$.
• Understand the meaning of $H$ and the distinction between exothermic and endothermic reactions. [*]
• Understand the relation between specific heat capacity and heat transferred. [*]
• Understand the relation between $\Delta H^\circ_{\text{rxn}}$ and amount of substance. [*]
• Understand the importance of Hess’s law and the manipulation of $\otimes H$ values.
• Understand the meaning of a formation equation and the standard enthalpy of formation.
• Understand how a reaction can be viewed as the decomposition of reactants followed by the formation of products. [*]
• Understand how the tendency of a process to occur by itself is distinct from how long it takes to occur. [*]
• Understand the distinction between a spontaneous and a nonspontaneous change. [*]
• Understand why the first law of thermodynamics and the sign of $\otimes H^\circ$ cannot predict the direction of a spontaneous process. [*]
• Understand how the entropy of a system is defined by the number of microstates over which its energy is dispersed. [*]
• Understand the criterion for spontaneity according to the second law of thermodynamics. [*]
• Understand how absolute values of standard molar entropies can be obtained because the third law of thermodynamics provides a “zero point.” [*]
• Understand how temperature, physical state, dissolution, atomic size, and molecular complexity influence $S^\circ$ values. [*]
• Understand how $\Delta S^\circ_{\text{rxn}}$ is based on the difference between the summed $S^\circ$ values for the reactants and those for products.
• Understand the relationship between $\Delta S_{\text{surr}}$ and $\Delta H_{\text{sys}}$. [*]
• Understand how reactions proceed spontaneously toward equilibrium but proceed no further once equilibrium is reached. [*]
• Understand how the free energy change ($\Delta G$) combines the system’s entropy and enthalpy changes. [*]
• Understand how the expression for the free energy change is derived from the second law. [*]
• Understand the relationship between $\Delta G$ and the maximum work a system can perform and why this quantity of work is never performed in a real process.
• Understand how temperature determines spontaneity for reactions in which $\Delta S$ and $\Delta H$ have the same sign. [*]
• Understand why the temperature at which a reaction becomes spontaneous occurs when $\Delta G = 0$. [*]
• Understand how a spontaneous change can be coupled to a nonspontaneous change to make it occur.
• Understand how $\Delta G$ is related to the ratio of $Q$ to $K$.
• Understand the meaning of $\Delta G^\circ$ and its relation to $K$.
• Understand the relation of $\Delta G$ to $\Delta G^\circ$ and $Q$.
• Understand why $G$ decreases, no matter what the starting concentrations, as the reacting system moves toward equilibrium.
• Be able to draw enthalpy diagrams for chemical and physical changes. [*]
• Be able to solve problems involving specific heat capacity and heat of reaction.
• Be able to use Hess’s law to find an unknown $\Delta H$.
• Be able to write formation equations and using $\Delta H^\circ_{f}$ values to find $\Delta H^\circ_{rxn}$.
• Be able to predict relative $S^\circ$ values of systems. [*]
• Be able to calculate $\Delta S^\circ_{rxn}$ for a chemical change using $S^\circ$ values.
• Be able to find reaction spontaneity from $\Delta S^\circ_{sys}$ and $\Delta H^\circ_{sys}$.
• Be able to calculate $\Delta G^\circ_{rxn}$ from $\Delta H^\circ_{f}$ and $S^\circ$ values.
• Be able to calculate $\Delta G^\circ_{rxn}$ from $\Delta G^\circ$ values.
• Be able to predict the signs of $\Delta H$, $\Delta S$, and $\Delta G$.
• Be able to calculate the effect of temperature on $\Delta G$.
• Be able to calculate the temperature at which a reaction becomes spontaneous.
• Be able to calculate $K$ from $\Delta G^\circ$.
• Be able to use $\Delta G^\circ$ and $Q$ to calculate $\Delta G$ at any condition.

Phase Changes, Liquids and Vapor Pressure:
• Understand how the interplay between kinetic and potential energy underlies the properties of the three states of matter and their phase changes.
• Understand the processes involved, both within a phase and during a phase change, when heat is added or removed from a pure substance. [*]
• Understand the meaning of vapor pressure and how phase changes are dynamic equilibrium processes.
• Understand how temperature and intermolecular forces influence vapor pressure.
• Understand the relation between vapor pressure and boiling point. [*]
• Understand how a phase diagram shows the phases of a substance at differing conditions of pressure and temperature. [*]
• Understand the types and relative strengths of intermolecular forces acting in a substance (dipole-dipole, hydrogen-bonding, dispersion), the impact of hydrogen bonding on physical properties, and the meaning of “polarizability.” [*]
• Be able to calculate the overall enthalpy change when heat is gained or lost by a pure substance.
• Be able to use the Clausius-Clapeyron equation to examine the relationship between vapor pressure and temperature.
• Be able to use a phase diagram to predict the physical state and/or phase change of a substance. [*]
• Be able to predict the types and relative strength of the intermolecular forces acting within a substance from its structure. [*]
**Nuclear Chemistry:**
- Understand how nuclear changes differ, in general, from chemical changes.
- Understand the meanings of “radioactivity,” “nuclide,” “isotope,” and “nucleon.”
- Understand the characteristics of $\alpha$, $\beta$, and $\gamma$ radioactive emissions.
- Understand the $^{A}_{Z}X$ notation that expresses the mass number, atomic number, and charge of a particle (including the alpha, beta, positron, neutron, and proton particles).
- Understand the various modes of radioactive decay and how each changes values of $A$ and $Z$.
- Understand how the $N/Z$ ratio, the even-odd nature of $N$ and $Z$, and magic numbers correlate with nuclear stability.
- Understand how an unstable nuclide’s mass number or $N/Z$ ratio correlates with its mode of decay.
- Understand how a decay series combines numerous decay steps and ends with a stable nuclide.
- Understand why radioactive decay is a first-order process; the meanings of “decay rate” and “specific activity.”
- Understand the meaning of half-life in the context of “radioactive decay.”
- Understand how the specific activity of an isotope in an object is used to determine the object’s age.
- Understand the units of radiation dose; the effects on living tissue of various dosage levels; and the inverse relationship between the mass and charge of an emission and its penetrating power.
- Understand how ionizing radiation creates free radicals that damage tissue; sources and risks of ionizing radiation.
- Be able to use changes in the values of $A$ and $Z$ to write and balance nuclear equations.
- Be able to use the $N/Z$ ratio, the even-odd nature of $N$ and $Z$, and the presence of magic numbers to predict nuclear stability.
- Be able to use the atomic mass of the element or the $N/Z$ ratio to predict the mode of decay of an unstable nuclide.
- Be able to calculate specific activity, decay constant, half-life, and number of nuclei.
- Be able to estimate the age of an object from the specific activity and half-life of carbon-14 and other radioactive isotopes.
- Be able to write notations and balancing equations for nuclear transmutation.
- Be able to express the mass number, atomic number, and charge of a particle with the $^{A}_{Z}X$ notation, including the alpha, beta, positron, neutron, and proton particles.

**Tips for Success in CHEM 215**
An appreciation and thorough understanding of chemistry is obtained one step at a time by developing an understanding of essential concepts. To do well in class, keep the following in mind:
- **Memorizing is NOT the way!** Memorizing facts is important but will not ensure your success in the course. Developing and understanding the concepts by working assigned problems is crucial. Do not simply memorize concepts or solutions to problems. Outline a solution procedure and then work through the problem by asking the so-called “why” questions.
- **Become involved in class!** Ask and answer questions during class. Be active in class and be assured that there is no such thing as a dumb question.
• **Utilize office hours!** As the instructor of the course, it is my intent and my goal to help you succeed in the course. If you are having trouble with the material and/or are uncomfortable asking questions in class, come by! I’m here to help.

• **DO NOT GET BEHIND!** Keep up with the material presented in class. Attending lecture regularly and paying attention while you are in lecture is the easiest way to stay on schedule. Do the homework problems (OWL and textbook) sooner rather than later. *Cramming chemistry is unproductive and painful!* Avoid having to do this at all costs!

• **Develop good study habits.** Effective study takes a great deal of time, effort and commitment to active learning. Studying on a daily basis and working daily with the material covered in class are both essential to learning and to success on exams.

• **Study daily to prepare for the exams and get a good night’s sleep before the exams.** If you think you can learn the material the night before the exam, let me assure you that this will NOT work unless you learn faster and remember more than SF State’s faculty. Learn to manage your time. Develop a schedule and set aside time to study daily for the exams.

• **Enroll in SCI 215.** Analysis of student performance indicates that students who enroll in the SCI supplementary instruction course earn a grade one-half to one-letter better in the primary course than would otherwise be predicted from the student’s record.

• **As you read the textbook, answer the “follow-up questions”; play the animations, and write down questions that you can’t answer.** Reading a chemistry textbook is not like reading a novel! Work slowly through the material, taking the time to ask yourself questions, solve problems, go back and re-read other sections of the textbook that are referenced.

• **Read the material again and again, and solve problems again and again.** Don’t simply look at the solutions manual or OWL’s answer. There’s a tremendous difference between reading a solution and deriving the solution. Your job isn’t to confirm that the OWL authors or Martin Silberberg solved a problem correctly, but to learn how to solve the problem yourself. Everybody makes false starts and hits dead-ends while trying to solve problems. You have to experience that process, and learn from those dead-ends, to fully understand the material.

• **Solve problems!** (Is this sounding repetitious?) You have to read the textbook to learn how to solve the problems, but the only way to learn the material is by solving problems. Return to a section that you’ve already studied, and randomly pick a few problems to solve. As an incentive, about half of each exam will be derived from OWL and textbook problems.

• **Don’t multitask!** Establish a schedule with sufficient time specifically set aside to study chemistry and solve problems every day (or at least every other day). Don’t oscillate between your chemistry work and any other task. You might think that you can read the textbook, listen to music on your iPod, read tweets and text messages, watch a short video, and answer an e-mail message. Cognitive psychologists, however, have data that indicates you’re wrong: You’ll learn less, and remember less, from multitasking sessions. Split the time up, and then devote full attention to one task at a time. Give yourself five minutes for text messaging, but then spend twenty minutes exclusively on chemistry. You will see that this method is more effective and less stressful. You’ll also be able to recall information better when you’re taking the exam.

**Suggestions for study groups:**

• Make sure that all students in your group are serious about studying and that at least some of the students are at your level of ability or better, and that some are below your level of ability.

• Assign a group leader who will arrange meetings, lead the meetings, and keep the group on task.

• Practice solving problems. Each person should work independently to prepare an outline for solving a problem, then discuss all of the outlines. Are there different ways to solve the
problem? Is one method best? Where is someone getting stuck? Can you reach a consensus for the solution method? Only at the very end of this discussion should you crunch the numbers. Don’t quit on a problem because you don’t immediately come up with the solution—if it’s a suggested textbook problem, keep working towards a solution.

• Brainstorm possible questions that you could be asked and answers you might give.
• Do not turn your study group time in to a socializing hour. You can socialize and have a great time after your group’s work is done.
• Make a study guide or cheat-sheet that has all of the formulas and important relationships that you need to solve the problems; then learn that information.

Suggestions for taking exam:

• To do well on an exam, you have to know the material and you have to know how to take the exam. Be sure to devote some time to take practice exams.
• Confidence plays a big role in doing well on exams.
• Set your alarm clock. If you live off-campus, check the traffic report. Make sure you will be able to arrive in time. Relax as much as you can.
• Bring a blue book (or green book), a calculator, a Scantron form, and a #2 pencil to the exam. Don’t wait until the morning of the exam to purchase the blue book or Scantron form.
• Scan the entire exam before beginning to answer problem/questions.
• Choose the problem or multiple-choice question that is easiest for you to solve first. Then continue solving questions that are easy for you. In this way you build confidence, which will help you solve the problems that you identify as hard.
• Read each problem/question carefully, and make sure you answer the question. If the problem has three parts, don’t answer just the first two parts.
• Show the solution for all problems. Give enough detail so that you, the instructor, and the grader know what you are trying to do. Even if you can do the problem in your head, don’t simply write down the numerical answer. To get credit, you have to show your work—there’s no credit for simple numerical answers. For example, if the problem asks how many grams of carbon dioxide could be obtained from the combustion of 16 g of methane, you can’t simply write “44 g,” even if you can perform the necessary calculations in your head.
• Be careful with significant figures. Do not report all the digits showing on your calculator; determine the number of significant figures, and adjust your result accordingly.
• Try to get at least partial credit on each problem. Perhaps you can only write an outline of a solution to a problem. That’s better than leaving the answer blank. This is especially important if you start running out of time.
• If you know that your numerical solution is physically impossible, but you can’t figure out your mistake, write that observation your exam. For example, if you calculate the pH of an acetic acid solution to be 9.3, you’ll get more partial credit if you write “but this is an acid, so the pH can’t be greater than 7” than if you simply identify 9.3 as the calculated pH.
• Stay in motion and budget your time. Work on a problem/question until you get stuck. If you get stuck, don’t stay with the problem/question. Go on to another problem!
• If you stay with a problem/question that you cannot solve, you will probably run out of time. To learn to budget your time, solve homework problems under time constraints, after you know the material.
• Make sure your work is legible. If the grader cannot read what you wrote, you can’t get credit. Solve the problem in a legible and organized fashion as it was demonstrated to you.
in class or OWL’s feedback.

- If you do not understand a question/problem, ask your instructor for help. Intelligently formulated questions may trick your instructor in giving you more information than was intended.

- Do not panic. If you start sweating and hyperventilating, put down your pencil, close your eyes, take a few deep breaths, and consciously relax clenched muscles (jaw, neck, stomach, etc.). When you are calmer go back to work. If this does not help, ask your instructor for permission to get some fresh air.

- If you have time at the end of the exam, check your solutions. Check that you answered all parts of a question. Analyze whether your answers make sense, and if numerical values are reasonable. (For example: is there really only 5 mg of oxygen in SCI 101?) Double-check your calculations, but only after completing all other reviews.

**Academic Deadlines and Policies**

**University course-repeat policy**

Effective Fall 2008, a student who has enrolled in a course and received a grade may repeat the course only once more, unless the course is described in the current SF State Bulletin as repeatable for credit. A withdrawal (W) counts as one of those two allowed grades. Also, an undergraduate student who has received a grade of C or higher may not repeat a course unless the course is described in the current SF State Bulletin as repeatable for credit. An undergraduate student cannot repeat any course once the student has repeated 28 units at SF State, unless the course is described in the current SF State Bulletin as repeatable for credit.

**University course-drop policy**

Effective Fall 2009, the drop period has been changed to the first two weeks of the semester. From the beginning of the third week through the twelfth week of instruction, withdrawal from a course is permissible, for serious and compelling reasons, by consulting the faculty member teaching the course. The student will receive a ‘W’ grade (Withdrawal) if the instructor, department chair, and college dean approve the withdrawal.

*College of Science & Engineering Course Procedures for Fall 2012*

**Dropping a course during the first two weeks of the Fall 2011 semester**

During the first two weeks of instruction, dropping a course(s) is permitted without academic penalty. No symbol is recorded on the student’s permanent record. Students are responsible for making changes to their official academic schedule. If you decide not to attend a class you enrolled in, you must drop that class through GATOR REG during access hours. If you have added a class during the first two weeks and then decide to drop, you must drop through the GATOR REG system during access hours. As a courtesy, you are expected to notify the instructor of your intent to drop the class.

**Through Sept 10:** Dropping class(es) using GATOR REG, 8 am to Midnight, Sunday through Friday.

**Withdrawing from a course after the first two weeks of the Fall 2011 semester**

After the first two weeks of instruction, withdrawal from a course is not permitted except for serious and compelling reasons. The "W" grade carries no connotation of quality of student performance and is not used as units attempted in calculating grade point average or progress points. The expectation of being dropped for nonattendance is not a sufficient reason for
withdrawal.

**Sept 11 – Nov 26:** Withdrawal from a course(s) is permissible only for serious and compelling reasons. If the withdrawal is approved, the student will receive a “W” grade.

PROCEDURE: Requests for withdrawal are to be reviewed by the Instructor and Department Chair. Students must submit their unofficial transcripts along with their petitions.

**Nov 27 – Dec 17:** Withdrawal from a course(s) is permissible only for serious and compelling reasons. If the withdrawal is approved, the student will receive a “W” grade.

PROCEDURE: All requests during this period must be reviewed by the Instructor, Department Chair, and Associate Dean. Students must submit their unofficial transcripts and appropriate documentations along with their petitions.

**CREDIT/NO CREDIT Option**

In a course where CR/NC grading is permitted, the student must notify the instructor and request it through GATOR REG **on or before October 23.** Requests for changes in grading option after the deadline are made on the Petition for Waiver of College Regulations form and must be accompanied by an ADD form. The CR/NC grading symbols carry no grade point credit. The CR grading symbol used in an undergraduate level course is equivalent to grades A through C- or in a graduate level course is equivalent to grades A through B-. Students should be aware that other institutions often interpret CR as a C grade and NC as an F grade in evaluating transcripts. Grading option change after the deadline is seldom granted.

*While CHEM 215 can be taken CR/NC, most majors that require CHEM 215 will require that it be taken for a letter grade. The College of Science and Engineering rarely approves a request to change a grading option after the deadline, so before choosing this option, consult an advisor in your major to fully understand the consequences of opting to take CHEM 215 CR/NC.*

**AUDITING a class**

To register in a class as an Auditor, the student must obtain instructor approval to audit by having the instructor sign an ADD form with the “Audit” bubble marked. Auditors may not change to credit status and vice versa **after the September 10 deadline.**

**Incompletes**

Grades of Incomplete (I) are given only for extraordinary, unforeseen, verified circumstances beyond the student’s control.