General Chemistry 1; Chem 11, Core Syllabus

Section 6, Lecture 60196

Fall 2010

1 General Information

Instructor: Dr. Thorsteinn Adalsteinsson

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Lecture times: Mondays, Wednesdays and Fridays 11:45 – 12:50 PM

Room: Kenna 308

Office hours: Wednesdays 14:00 – 16:00 (Chem 11). Alternative times are on Tuesdays between 13:30 – 16:45 (Chem 151)

Final exam: Monday December 6th, 13:30 – 16:30

2 Course overview and expectations

This is the first quarter of a two-quarter general chemistry sequence designed for science majors and engineering students. Topics covered this quarter will include: Stoichiometry, solutions, thermochemistry, atomic and electronic structure of atoms, and bonding. A number of concepts within each topic will be demonstrated and sample problems discussed. These topics will be covered at a brisk pace in lectures, which is normal to academic science courses.

2.1 Prerequisites for this course:

A working knowledge of basic concepts covered in high school chemistry courses and some ability to set up and manipulate algebraic equations is a prerequisite for this course. Students that have taken an advanced placement course in high school will be better prepared, but this preparation does not preempt study in this course and does, by no means, guarantee a high grade in the gourse.

The first week of lectures will briefly review the prerequisite material for students less prepared (chapter 1 – 3 in the book). Much of the introductory material will be re-enforced in the laboratory part of the course.

2.2 Workload

The course requires a significant time commitment from you. This commitment is both in terms of preparing/reading before lectures and reviewing the material and doing problems after the lecture. In the ten weeks of classes, we will cover the first nine chapters of the book, with two lectures set aside for in-class exams. Not every topic will be covered in great detail, but there is an understanding that you will explore each topic in greater depth through solving problems.

3 Course material

3.1 Textbooks and registration:

Required: "Chemistry: The Central Science, 11th edition" by T. Brown, G. LeMay, B. Bursten and C. Murphy (Prentice Hall:New Jersey, 2008) NOTE: The text should come shrink-wrapped with a copy of the "red" solutions manual.

Recommended: Registration for both the course website (ANGEL site) as well as the homework problem website (Mastering Chemistry site).

Required: "Laboratory Manual for General Chemistry I, Fall 2009 Edition." SCU Department of Chemistry.

Required: "Clickers" - these are available at the bookstore.

Required: Completion of the laboratory component of the course.

3.2 Other supplies and miscellany:

Each of the following supplies should be purchased:

Required: For lab component; Chemical splash goggles for laboratory work.

Required: For lab component; Closed toed shoes. Please select foot ware that are more water resistant than standard running shoes or similar breathable foot-ware.

Required: For lab component; A bound (not spiral) quadrille lined notebook for laboratory.

Recommended: For lab component; Pants (not shorts or pajamas) for your protection in case of a chemical spill or broken glass.

Recommended: A calculator capable of exponential notation, logs, and antilogs. I recommend that you purchase a "simple" calculator for this course. You will not need a graphing, or programmable calculator, and calculators often get lost or get spilled on in lab. Think about spending some $15 on a calculator for this course.

3.3 Websites:

The following websites will be maintained in the course

Recommended: ANGEL WEBSITE: This website will contain *all* handouts that I prepare for the course as well as any powerpoint slides from the lecture. The *full* syllabus will be posted on this website for your reference. I will also be posting the course grade roster directly on the website. No names will be listed on the roster. Grades will be listed by the last four numbers on your student ID.

Please note: The material that I prepare for this course is the property of the university and should be treated as a copyrighted material. Do not distribute this material to anyone outside of this course.

Highly Recommended: MASTERING CHEMISTRY WEBSITE: A registration code for this service is included in your textbook package if you purchase it from the bookstore. If you are using a used textbook, you can purchase access on the website. Example problems and tutorial problems will posted on this website every week. The problems are automatically graded for training purposes, *a low grade will not count against you in any way.* **The purpose of this website is to serve as an endorsement + assistance in applying the knowledge covered in class. Your participation on the website will help me gauge if any part of the material will need to be covered in more detail.**

To activate this service, follow the instruction material provided with the book. This course should be under: ADALSTEINSSON60196

3.4 Class assistance:

The Drahman center: The center manages academic advising, disabled student resources and learning resources. At the beginning of the quarter the center is quite busy with students seeking assistance. The center does an excellent job in obtaining help for students that truly need additional assistance. The Drahman center is located in Benson Memorial Center, Room 214. The website for the center is at: http://www.scu.edu/advising/ .

Tutoring sessions: The Chemistry department has hired peer tutors to hold sessions where problems in the General Chemistry sections can be brought up. All sessions are held between 6 – 8 pm Weeks 2 – 9; tutoring week 10 is optional based on availability of the individual tutors.

Office hours: Office hours are time where you can meet with the course instructor to discuss and seek assistance. Problems discussed during office hours are often brought back up during lectures, so seeking help may help others. The office hours for this course is between 2 pm and 4 pm on Wednesdays.

Individual tutors: Individual tutors can be contacted through the Drahman center website. The number of such tutors is limited and students are served on first-come, first-serve basis. Please be considerate of the limited number of tutors available, it may not be appropriate to demand this resource if you are concerned that you may only be getting an A^- rather than an A.

4 Some notes on how to study chemistry

The biggest challenge you will face in this, and any other courses at Santa Clara University, is to develop an efficient study methods.

1. *Read before, read after:* Skim the chapter before it is covered in lecture; this will help familiarize you with some of the terms associated with each topic. Review each chapter after it is covered in class; this will help you become familiar with the book and make it easier to review before exams.

2. *Participate during class:* Take notes during class and look over them afterwards. Don't skip class. Ask questions.

3. *Do the work:* Do the assigned problems as close to the time as when the topic is covered in the class, *even when they are not graded*; they are designed to help you to increase the depth of your understanding of specific concepts and to give you practice in problem solving. This will also shorten the time you take to solve problems and time is limited during exams.

4. *Do not wait until the night before the exam to study:* This approach does not work.

5. *Find a group of students to study with:* Seek out students dedicated to doing well in the course. These students can be found in drop-in tutoring sessions, or in the library studying. This group will help you stay focused and may assist you when things get confusing. Furthermore, explaining difficult concepts to others is an efficient way to learn yourself.

6. *Stay focused:* Find an environment on campus with few distractions to work on the course material. *Your dorm bedroom is not this space.*

5 College of Arts and Sciences Performance Standards in the Sciences:

This course is a prerequisite for Chemistry 12 (General Chemistry II). In order to satisfy the prerequisite and be eligible to enroll in Chemistry 12 you MUST complete Chemistry 11 with a grade of C- or better. If you do not meet the performance standard as stated, it is your responsibility to not enroll, or to withdraw from pre-enrollment, for the next course in the sequence. If you do enroll for a course for which you do not qualify, you are subject to Administrative Withdrawal on the first day of class.

5.1 Disability accommodation policy:

To request academic accommodations for a disability, students must contact Disability Resources located in The Drahmann Center in Benson, Room 214, (408) 554-4111; TTY (408) 554-5445. Students must provide documentation of a disability to Disability Resources prior to receiving accommodations. It may take a week or two to set up an accommodation so do it ASAP.

5.1.1 Additional time/assistance during exams

All request for extra time on exams and graded exercises are considered disability accommodation. All such assistance must be processed by the Drahman center and can not be granted by the instructor alone.

5.2 Academic Dishonesty:

Academic dishonesty includes looking at another student's test during an exam, allowing another student to copy your work, use of unauthorized materials (e.g., lecture notes, crib sheets, textbooks, inappropriate electronic devices) during an exam, presenting lab reports that are not your original work and recording laboratory data that was not actually observed ("dry labing"). DISHONESTY IN ANY ASPECT OF THE COURSE WILL RESULT IN A COURSE FAILURE.

6 Evaluation of coursework:

In the course, eight quizzes, two midterms, a final exam and lab score will be evaluated to assign a final grade for the course. A breakdown of point value given for each of these components is given in Table 1

Table 1: Distribution of points used for course evaluation

Exercise	# assigned	Points each	Total points
Attendance	25	2	50
Quizzes	6/8	25	150
Midterms	2	200	400
Final Exam	1	400	400
Laboratory	Honor/Pass/Fail assigned by lab instructor		

Past experience has shown that score above the 80% of total point values given is *likely* to result in a grade of B or above. Score above 90% will most likely be awarded an A^- or A grade. Since the course attracts many good students with strong background, approximately 40% of the students will score B or above. The actual letter grade for the course will be assigned using the total score as a guide, but it remains a subjective decision of the instructor based on general evaluation of the class as a whole.

6.1 Laboratory grading:

Your grade is influenced by your performance in the laboratory. *Failure to complete the laboratory equals failure in the course regardless of performance in exams and other evaluations.* Successful completion of the laboratory is;

1. earning at least 75% of the laboratory points (150/200),
2. having no more than one unapproved absence, and
3. having no more than two total absences (even if approved).

For most students, the lab grade has no effect on course grade. However, a small number of students who perform *exceptionally* well in the lab will receive a 1-2% bonus added to their course score.

6.2 Attendance:

Attendance int he course will be taken via "clicker" questions that will be posted some time in the first 10 minutes of the lecture. These questions may, or may not be relevant to the material from the last class. You will not be graded on the correctness of your answer, but your participation will count.

6.3 Quizzes:

Total of eight short in–class assignments will be given on Fridays, except in weeks where midterms are held. Approximately 15 minutes of class time will be given to the quiz at the end of the class period. The score (%) from the six highest scoring assignments will be collected into the final evaluation. This allows you to skip two quizzes if conflict arrises without penalty in your grade. Due to this flexibility, no makeup quizzes will be given during the quarter.

6.4 Midterms:

Attendance in both midterms is required. Absence must be supported by a note from a doctor, in such cases makeup exams will be given. Athlete students can take the exam on the road, if an agreement with a coach or another supervisor is available. The duration of each midterm is approximately one hour.

6.5 Final exam:

Attendance in the final exam is required. Absence must be supported by a note from a doctor. In such cases, the course will be filed as incomplete and a final exam must be re-scheduled through a direct contract with the instructor. The duration of the final exam is three hours.

7 Approach and material covered

Lectures will be based around blackboard-led discussions. Lecture outlines and discussion guides will be on a data projector in the lecture room. The slides scheduled to be shown in lecture will be available online on the ANGEL website. Throughout the course, some additional review or highlight slides may be inserted, but the additional slides will *not* be added to the online versions.

The lectures should be focused around problems solved on the blackboard and discussion around the understanding and implications of the solutions of the problems. Similar problems can be found at the back of the book chapter.

YOU ARE STRONGLY ENCOURAGED TO DO AS MANY OF THE TEXTBOOK IN-CHAPTER AND END-OF-CHAPTER PROBLEMS AS POSSIBLE. This work will help you to gain a better understanding of the lecture material. Most of the questions on exams may be derived from problems found in the text.

7.1 Material covered

The chapter coverages listed are approximate. Key sections for each chapter are noted below, but the actual coverage may include more, or less of the chapter. Changes in chapter coverages will be announced in class and may include a request that you become familiar with the material independently.

A short list some exercises is also provided to get you started. This should be considered as an absolute minimum set. The answers to most of these problems are in your solutions manual; the answers to "black" problems are posted in the glass cases outside of the DS200 building[1]. Problems marked with an asterisk (*) may be more challenging.

For suggested problems from the chapter, go to MasteringChemistry.com. Many of the assigned problems are identical the problems from the back of the chapter. Additional problems may be suggested during lectures.

Chapter 1: Introduction: Review of units of measurement, uncertainty (precision and accuracy; significant figures), and dimensional analysis.

Key sections: 1.2-1.6

Chapter 2: Atoms, Molecules, Ions: Review of nomenclature (naming compounds); chemical equations; atomic and molecular weights; the mole (all of these subjects as well as basic structure of the atom are part of the prerequisite: high school chemistry)

Key sections: 2.3-2.8

Chapter 3: Stoichiometry: Calculation of percent compositions and determination of chemical formulas; quantitative information from balanced equations; limited reagents, theoretical yields.

Key sections: 3.1-3.4 covered briefly, 3.5, 3.6, 3.7 in more depth

Chapter 4; Aqueous reactions and solution stoichiometry: General concepts; molarity; kinds of chemicals in solutions (strong or weak electrolytes, salts, acids, bases); reactions in solution (neutralization, metathesis, redox reactions, etc.); ionic and molecular equations.

Key sections: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6

Chapter 5; Thermochemistry: Energy; enthalpy; enthalpies of reaction; Hess's law; calorimetry; calculation of enthalpy changes

Key sections: (5.1), 5.2, 5.3, 5.4, 5.5, 5.6, 5.7

[1]Be aware that there may be occasional errors in the solution manual.

Chapter 6; Electronic structure of atoms; Evidence for energy levels in atoms (atomic absorption/emission); structure of the hydrogen atom (Bohr Model); orbitals and quantum numbers; electronic configurations of other atoms; electron spin and the Pauli exclusion principle

Key sections: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9

Chapter 7; Periodic properties of the elements: Introduction to periodic table; electron shells; size of atoms and ions; ionization energy; electron affinities; chemical properties/periodic trends in properties

Key sections: 7.2, 7.3, 7.4, 7.5, 7.6, 7.7

Chapter 8; Basic concepts in chemical bonding: Lewis structures and the octet rule; ionic bonding; covalent bonding; multiple bonds; formal charge; resonance forms and exceptions to the octet rule; bond strength/length; bond polarity and electronegativity

Key sections: 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9

Chapter 9; Molecular geometry and bonding theories: VSEPR theory; dipole moments; valence bond theory; orbital hybridization; hybrid orbitals and multiple bonds

Key sections: 9.1, 9.2, 9.3, 9.4, 9.5, 9.6

8 General learning objectives:

The primary objectives of the general chemistry sequence is to give you a solid foundation in both theoretical and descriptive chemistry. Special emphasis will be placed on development of problem solving skills as well as on the application of basic chemical concepts. We will accomplish this goal using a variety of activities. These will include lectures, laboratory experiments, problem solving, examinations, and a lot of individual effort outside of the classroom. It is imperative that you do as many of the end-of-chapter problems as possible.

The laboratory portion of the course will provide you with the opportunity to develop skills necessary for scientific discovery (e.g., critical thinking and observation skills, ability to handle chemical reagents and instruments safely). The laboratory experiments this quarter will include those designed to introduce you to topics not covered in lecture (enrichment) as well as those designed to reinforce or introduce some of the topics discussed in lecture.

8.1 Basic learning objectives:

The following is a list of specific learning goals and objectives for the course. A small number of additional special topics, chosen at the discretion of the instructor, may be added during the term. These will be announced in class.

Goal 1: Learn the fundamentals of the properties of matter, measurement and uncertainty. The specific objectives are:

(a) Be able to distinguish elements from compounds, pure substances from mixtures and homogeneous from heterogeneous mixtures (solutions). Learn rudiments of mixture separation into pure substances and the distinction between physical and chemical properties.

(b) Learn and be able to use SI units, derived SI units and metric prefixes, including the recognition of the uncertainty in measurements, the correct use of significant figures and routine employment of dimensional analysis in problem solving.

(c) Understand the difference between accuracy and precision.

GOAL 2: Acquire a thorough understanding of the modern theory of atomic structure and atomic level phenomena. The specific objectives are:

(a) Be intimately familiar with the properties, atomic locations and interactions of protons, neutrons and electrons.

(b) Understand the concept of isotopes and factors affecting nuclear stability.

(c) Understand the implications of the uncertainly principle, wave mechanics and the quantization of electrons energies and spin, including quantum numbers, atomic orbital energies/shapes/electron capacity and writing of electron configurations for atoms and monatomic ions.

(d) Understand the phenomenon of atomic absorption and emission and be able to distinguish ground from excited state atoms.

GOAL 3: Begin to learn the symbolism and terminology (language) of chemistry. The specific objectives are:

(a) Learn the symbols and names of dozens of the common chemical elements, realizing the foreign roots of some.

(b) Be able to name common cations and anions, ionic and binary covalent compounds given the chemical formula.

(c) Be able to write the formulas of common cations and anions, ionic compounds and binary covalent compounds given the name.

GOAL 4: Obtain a thorough introduction to modern chemical bonding theories and their implications. The specific objectives are::

(a) Understand the difference between ionic and covalent bonding and be able to recognize ionic compounds from formula.

(b) Be able to distinguish valence from core electrons, depict the former using representative element Lewis symbols and learn to draw Lewis structures, recognize resonance and predict both VSEPR and actual geometry for simple covalent molecules and polyatomic ions. Learn the atomic orbital hybridization model in relation to VSEPR theory.

(c) Learn the use of electronegativity as a predictor of ionicity in binary compounds and as a bond polarity predictor in covalent species and be able to predict if compounds have a zero or non-zero dipole moment.

(d) Learn the difference between sigma and pi bonding, know what atomic orbital overlap is associated with any covalent bond.

(e) Begin to learn the difference between the valence bond and molecular orbital theories of bonding.

GOAL 5: Learn the organization and information conveyed by the periodic table of the chemical elements. The specific objectives are:

(a) Learn the rationale for the tables structure and the special names of various columns or other groupings of elements.

(b) Know trends in metallic character, atomic radius, ionization energy, electrons affinity and electronegativity in the periodic table.

(c) Know the relationship between position in the periodic table and the likely chemical bonding behavior of an element.

GOAL 6: Begin to learn and categorize selected types of chemical reactions. The specific objectives are:

(a) Learn to recognize acids, bases and salts and begin to learn to predict the products of acid/base reactions.

(b) Learn to recognize strong, weak and non-electrolytes and the role of non-electrolyte and weak electrolyte formation as a driving force for reactions of solutions of strong electrolytes with one another and selected solid ionic compounds.

(c) Begin to learn about oxidation/reduction terminology and reactions, particularly metal replacement reactions.

GOAL 7: Understand the quantitative implications of chemical formulas and chemical reactions, including processes occurring in solution. The specific objectives are:

(a) Learn the importance and use of Avogadros number and the mole concept in relating the atomic/molecular level to the macroscopic level.

(b) Be able to determine empirical and actual formulas of chemical compounds from elemental analysis data.

(c) Be able to make gram/mole conversions and calculations relating to chemical reactions, including limiting reactant/theoretical yield/percent yield calculations and including reactions occurring in solution.

(d) Begin the learn chemical concentration units, particularly molarity.

GOAL 8: Understand the various forms of energy and the various roles energy plays in physical processes and chemical systems and reactions. The specific objectives are:

(a) Become very familiar with the characteristics of electromagnetic radiation and how it interacts with matter.

(b) Be able to complete and balance combustion reactions of C,H,O,N,S containing compounds.

(c) Understand the methods and calculations of basic calorimetry.

(d) Learn the First Law of Thermodynamics and its chemical implications.

(e) Learn and use Hesss Law as applied to physical processes and chemical reactions.

(f) Learn the role of enthalpy in physical and chemical processes, including the meaning and the manipulations of enthalpies of formation.

(g) Learn about the energy content of food types and chemical fuels.

8.2 Natural science core learning goals and objectives:

The following goals are specified by the School of Arts and Science as a guiding principle for courses that are specifically targeted at the introductory level.

GOAL: Scientific inquiry, complexity, critical thinking, mathematical and quantitative reasoning. The specific objectives are:

(a) Demonstrate an understanding of the theory and concepts central to the study of a particular area or topic treated by the natural sciences.

(b) Understand how to formulate a testable hypothesis and design an informative experiment to explain phenomena observed in the natural world.

(c) Be able to interpret data from scientific experimentation both qualitatively and quantitatively, in order to derive conclusions appropriate to the scope and quality of data.

(d) Be able to recognize limitations of experimental and observational methods and understand concepts of probability, causation, and correlation.