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Santa Clara University
Department of Chemistry and Biochemistry

General Chemistry I **Fall 2010**
Chemistry 11 **Lecture Syllabus**

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Course Topics: This is the first quarter of a three-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. These topics will be covered at a VERY brisk pace; it is imperative that you not fall behind.

Prerequisites for THIS course: A working knowledge of basic concepts covered in high school courses in chemistry and algebra is a definite prerequisite for this course! You are encouraged to review Chapters 1-3 in the lecture text (with particular emphasis on nomenclature, moles, structure of the atom) prior to the second meeting of lecture. We will cover some aspects of this in class or in lab but only as a brief review of material that is considered to be part of the prerequisite body of knowledge you should have mastered in your high school chemistry course.

Required Textbooks and Supplies:

(1) **Chemistry: The Central Science, 11th edition**
by T. Brown, G. LeMay, B. Bursten and C. Murphy (Prentice Hall: New Jersey, 2008)
NOTE: The text available at the bookstore should come bundled with a copy of the "red" solutions manual. I recommend that you get the bundle that also includes on-line access to the tutorial program site, Mastering Chemistry. This does not add a lot of extra cost to the bundle AND the MC access includes free on-line eBook subscription for at least one year! That is a pretty good deal, even if you don't intend to use the MC tutorials... MC is, however, optional for my section of the course.

(2) **Laboratory Manual for General Chemistry I, Fall 2010 Edition**
SCU Department of Chemistry and Biochemistry. This is available at the bookstore.

(3) A **notebook** is required for laboratory. This should be a bound notebook (NOT spiral) with lined pages, preferable quadrille lined.

(4) **Chemical splash goggles** and appropriate laboratory attire are **REQUIRED**.

Electronic Devices (allowed and prohibited):

(1) An electronic calculator is essential for this course. An appropriate calculator for use during in-class graded exercises is the **TI-30X** or **TI-30Xa** (with or without solar power) by Texas Instruments. This calculator is inexpensive ($10-$20) and has all of the basic features needed for completing in-class graded lecture exercises. You may use this calculator or one with similar features however you must limit your calculator selection to one that is nonprogrammable; see me if you have any questions as to the suitability of your preferred calculator. The use of more sophisticated electronic devices on any in-class graded lecture exercise is prohibited.

(2) The use of any electronic devices (pagers, cell phones, etc.) other than the above mentioned approved calculators during any in-class graded lecture exercise is **prohibited** and may result in the loss of all credit for the graded exercise in question. All such devices must be turned off during any graded exercise.

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 from the course.

Disability Accommodation Policy:
To request academic accommodations for a disability, students must contact Disabilities Resources located in Benson Memorial Center, Room 216, (408) 554-4109; TTY (408) 554-5445. Students must provide documentation of a disability to Disabilities Resources prior to receiving accommodations. It may take a week or two to set up an accommodation so do it ASAP.

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, copying lab reports from other students and recording laboratory data that was not actually observed ("dry labing"). **CHEATING IN ANY FORM WILL NOT BE TOLERATED AND MAY RESULT IN FAILURE OF THE ENTIRE COURSE.**

Laboratory Procedures:
Please note that you must successfully complete and pass the laboratory section of the course in order to pass the class. Please carefully review the schedule for the laboratory section provided in the Laboratory Manual.

As required by the Department of Chemistry and Biochemistry, laboratory attendance is absolutely mandatory.

The Chemistry 11 laboratory will be graded on a modified pass/no pass basis. Students must show proficiency in the laboratory portion of the course and fulfill the minimum attendance requirement as indicated below:

(1) In order to be eligible for a course grade of D- or higher you must not accumulate more than one unapproved absence or two total absences (for any reason excused or not) from lab. In rare cases make-up labs may be possible but this is left to the discretion of your individual laboratory instructor.

(2) In order to be eligible to earn a course grade of C- or higher you must earn an average minimum score of 75% (150 points) on all lab procedures and tasks. Traditionally we have found that most students earn fairly high average scores in lab (usually around 85% of the total or higher) so the 75% minimum is reasonably generous.

(3) Laboratory instructors will designate all remaining students in the following categories:

Very High Pass:	Adds 2% to total lecture points (20 points added)
High Pass:	Adds 1% to total lecture points (10 points added)
Pass:	No effect on total lecture points
Low Pass:	Subtracts 1% from lecture points (-10 points deducted)

Lecture Procedures:
There will be no graded homework turned in this quarter however it is vital that you regularly test your knowledge of the course concepts by doing homework problems. You are **STRONGLY, VIGOROUSLY, AND ENTHUSIASTICALLY ENCOURAGED** to do as many of the in-chapter and end-of-chapter problems as time permits; a list of recommended end-of-chapter problems may be found at the end of the syllabus. Text problems, in slightly altered form, may appear on exams. In addition to the assigned end of chapter problems, you are encouraged to utilize the Mastering Chemistry website, which features a large range of additional problems for you to try.

There will be a variety of graded examinations given during the quarter. In addition to a short quiz on chemical nomenclature, there will be 2 mini-midterms that will take approximately 1/2 of the class period to complete (the remainder of the period WILL be used for lecture!), 2 one-hour midterms, and a comprehensive final exam. A tentative schedule for examinations is given below; the date for each exam will be finalized approximately one week prior to the exam. As a safety net for you this quarter the lower midterm exam score will be dropped. Please note that exams will be given only during the scheduled exam period. It is your responsibility to make sure that you are present at each exam. Please do not ask for a make-up exam as these will not be given; if you miss a midterm exam **for any reason** (health, sports, family obligations, travel plans, etc.) the midterm you miss will be counted as the dropped midterm. If you miss the quiz or a mini-midterm, the weighting of the final exam will be increased accordingly. You must take the final exam during the exam period scheduled for your section of Chemistry 11. Please consider these exam dates/times when you and your family begin making your Thanksgiving Holiday or quarter break travel plans.

Tentative Schedule for Exams:
Exams are given in the regular lecture room. With the exception of the Final Exam, you are not permitted to leave the testing room until you turn in the graded exercise. The Final Exam will be given in two parts to accommodate a brief break if needed. Graded exercises must be taken in the section in which you are officially enrolled.

Nomenclature Quiz:	Friday 10/1 (week #2)
Mini-Midterms:	Friday 10/8 and Friday 11/5 (weeks 3, 7)
Midterms:	Friday 10/22 and Friday 11/19 (weeks 5, 9)
Final exam:	9:15 MWF section: Wed 9:10 am -12:10 pm
	10:30 MWF section: Fri 9:10 am -12:10 pm

Grading: Total points for the quarter will be tentatively distributed as follows:

Exercise	**# per qtr**	**points per**	**total points**
Nomenclature Quiz	1	25	25
Mini-Midterms	2	150	300
Midterms	2	325	325 (after dropping low score)
Final	1	350	350
Laboratory	N/A	N/A	pass/fail

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 (i.e., a curve).

Tentative Lecture Schedule

The chapter topics listed below are approximate. Key sections for each chapter are noted below. Sections in parentheses should be learned on your own. Changes in chapter topics will be announced in class.

Chapter	Topics
Chapters 1-3	Stoichiometry Review of units of measurement, uncertainty (precision and accuracy; significant figures), and dimensional analysis. 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). Calculation of percent compositions and determination of chemical formulas; quantitative information from balanced equations; limited reagents, theoretical yields. Key sections: (1.2-1.6), (2.3-2.8), (3.1-3.4), 3.5, 3.6, 3.7
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, etc.); ionic and molecular equations Key sections: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6
Chapter 5	Energy relationships in chemistry (Thermochemistry) Energy; enthalpy; enthalpies of reaction; Hess's law; calorimetry; calculation of enthalpy changes; applications Key sections: (5.1), 5.2, 5.3, 5.4, 5.5, 5.6, 5.7
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
Other:	Special topics as time permits (TBA)

Starter Set of Suggested Problems: The following is a list of some suggested exercises to get you started; similar sets of suggested exercises will be assigned later in the term for Chapters 6 to 9. We will start the term with Chapter 3 but you are expected to recall basic chemistry principles from your high school chemistry course (a Chemistry 11 prerequisite) so I've included some sample exercises from Chapters 1 and 2 to help guide your review.

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. Problems marked with an asterisk (*) may be more challenging. You should to do as many of the textbook in-chapter and end-of-chapter problems as possible (try more than just the ones in the suggested sets!). These will help you to gain a better understanding of the lecture material. In addition, some of the questions on exams may be derived from problems found in the text.

Chapter 1	23, 33, 35, 37, 41(a-b), 43 (a-c), 47
Chapter 2	21, 23, 29, 37, 39, 43, 45, 51, 5, 57, 59, 61, 63, 67, 69
Chapter 3	3, 5, 9, 10, 11, 13 (a-c), 21, 23a, 31, 33, 35, 37, 39, 43, 47, 49a, 51, 53, 57, 59, 61, 63a-b, 67, 69, 71, 73, 75, 77, 89*, 93
Chapter 4	1, 3, 5, 7, 15, 17, 19, 21, 23, 25, 29, 31, 33, 37, 39, *41, 45, 49, 51, 55a-c, 59, 61, 63, 65, 67, 69a, 73, 75, 79, 81a-c, 83, 85, 87*, 92, 104
Chapter 5	17, 23, 31b, 37a, 41, 43, 47a-b, 49, 51, 53, 59, 61, 63, 65, 67a-b, 69

Warning!!!!!!! There may be a few errors in the solutions manual for the text--this is not unusual for a solutions manual.

Some Notes on How to Study Chemistry

1. **If time permits, skim the chapter before it is covered** in lecture; this will help to familiarize you with some of the terms associated with each topic. Skim to get the vocabulary down.
2. **Get the most out of lecture** (e. g., take good notes, don't skip classes, ask questions)
3. **Read each subsection of the chapter** in the textbook after it is covered in class. Try the in-chapter solved exercises.
4. **Do end-of-chapter problems**; they are designed to help you to increase the depth of your understanding of specific concepts and to give you practice in problem solving. Try not to look at the solutions manual answer to a problem until you have worked on it for a bit. You won't have a solutions manual to look at during exams!!!
5. **If you need extra help** with a topic or a problem, be sure to seek out that help ASAP. Do NOT wait until the "night before the exam" to study chemistry; it does not work. I have arranged for peer drop-in tutoring Tues, Wed, and Thursday evenings from approximately 6-8 pm weeks 2-9 (location: TBA). See me in office hours or go to the drop-in tutoring if you need help.
6. **Exams are also a learning exercise**: you will have access to a detailed key for each mini-midterm or midterm after the tests have been returned. Be sure to consult these keys to get additional feedback. Please see the instructor in office hours if you have questions about how to improve your performance on graded exercises.

General Learning Objectives: The primary objective 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.

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.**

Objectives:

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.**

Objectives:

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.**

Objectives:

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.**

Objectives:

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.**

Objectives:

a. Learn the rationale for the table's 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.**

Objectives:

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.**

Objectives:

a. Learn the importance and use of Avogadro's 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.**

Objectives:

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 Hess's 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.

Natural Science Core Learning Goals and Objectives:

Goal: Scientific Inquiry, Complexity, Critical Thinking, Mathematical and Quantitative Reasoning

Objectives:

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.