CHEMISTRY 11 (60192)
GENERAL CHEMISTRY I

SANTA CLARA UNIVERSITY
FALL TERM, 2010

COURSE SYLLABUS

INSTRUCTOR: Dr. Steven L. Fedder
Phone: 554-4884 - voice mail after 5 rings
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FAX: 554-7811

TIME AND PLACE: Kenna Hall, Room 308
MWF 9:15am – 10:20am

OFFICE HOURS: Office – Daly Science 104

Times – Monday, Wednesday and Friday from 2:00 – 3:30pm - on the third Wednesday of each month I have an important meeting which requires me to adjourn office hours at 3:20pm. Thanks!

Other times may be possible by arrangement

REQUIRED MATERIALS:

1) Chemistry, the Central Science, 11th Edition, by Brown, Lemay and Bursten, Prentice/Hall, Inc.

2) A pocket calculator capable of scientific notation/logarithms, etc. Cost = $15. A solar powered model eliminates the problem of dead batteries.

3) A 3-ring binder for notes to be interleaved with class handouts and extra problem sets. **Handouts will be sent to your SCU email as PDF files for you to print out and bring to class.**

4) For laboratory, a bound notebook and safety goggles. The latter will be made available for sale by the Chemistry Club during the first two weeks of classes.

COURSE CONTENT:

Although most students entering SCU have taken a chemistry course in high school, it was often during the sophomore year and likely varied greatly in quality, so I assume minimal prior knowledge of chemistry but a high level of interest in learning about it. Chemistry 11 **learning objectives include** exposure to and an understanding of 1) the language of chemistry including chemical nomenclature, symbols and common units of measurement, 2) stoichiometry; the chemical arithmetic associated with the formulas for chemicals and with balanced chemical reactions, 3) the driving forces involved in reactions of aqueous solutions of strong electrolytes, 4) the internal structure of atoms, particularly the allowed energies of and behavior of an atom's electrons, 5) the concepts of ionic and covalent bonding, 6) the accepted theory predicting the shapes of molecules including the concept of atomic orbital hybridization, 7) the heat changes associated with chemical reactions and physical processes. The information will be integrated as much as possible and will be presented using relevant examples from the consumer, medical and environmental arenas to provide a context for the learning. Pages 4-6 give a much more detailed list of learning objectives.

RECOMMENDED APPROACH : Although everyone's learning style is somewhat different, the following suggestions seem to help most people.

-Please DON'T MISS CLASS, unless it is absolutely unavoidable. If you do miss a class, please obtain class notes and any handouts for that day from a classmate.

-Do any assigned reading before class.

-Take good notes, but not at the expense of listening to what I am saying.
-you may want to bring 2-3 different color pens or pencils for more effective note taking.
-don't forget to use your class notes and handouts as a substantial part of preparing for exams.

-If possible, please take 10 minutes before each class to look over the notes from the previous class; this is very valuable in resetting the context for the material.

-Do assigned problems faithfully, with an eye toward answering the question "What was the author trying to test my knowledge/understanding of with this question"?

-Be coachable; I've helped thousands of students learn chemistry over the years and certain approaches (like these suggestions here) really do work.

-Ask questions when you are confused; don't let "the veil" descend and not attempt to immediately pull it back up.

-Don't underestimate the importance of repetition in learning chemistry. In many ways, chemistry can be likened to a foreign language; by focusing on the things that are repeated frequently, you not only learn them, but get the idea that they must be more important than something you hear or read about only once. Reading over your lecture notes (even if there isn't an exam coming up) helps with more repetition.

HOMEWORK:

Although I don't collect or grade homework, it is **crucial to do** it to convert the passive learning of the classroom and your readings into active learning. I'll provide you with a list of the whole quarter's problem assignments immediately, and may give some of my own problem sets as well. The Study Guide/Solutions Manual that comes shrink-wrapped with your text is available to give you feedback on homework. If a question or problem still stumps you, even after consulting the Solutions Manual, that is when an email to me or visit to office hours is called for.

ASSESSMENT:

1) Midterm exams - 2 of them (hour long w/ assigned seats) - see lecture schedule for approximate dates
2) Final exam - Wednesday, December 8 from 9:10am – 12:10pm in Kenna 308
3) Laboratory performance - contributes a small amount toward course grade

GRADING:

2 exams at 175 points each	= 350 points
Final exam	= 250 points
Laboratory	= variable*
Total points	= ~600 points

Grades will be based largely on your performance on the 2 exams (175 points each) and the final exam (250 points). *Your grade is also influenced by your performance in the laboratory. Failure to complete the laboratory is grounds for failure in the course. Successful completion of the laboratory is defined as (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). The majority of people who complete the laboratory will find that it has no effect on their course grade. However, a small number of people who perform exceptionally well may receive a 1-2% increase in their exam point total (7-14 points), and a small number of people who perform particularly poorly may receive a 1-2% decrease in their exam point total.

Letter grades are based on how I feel the class has done relative to the difficulty of the exams and relative to students in the same class over a period of years. I'll include an approximate letter grade with each returned exam to give you a sense of what you've earned. **Focus on the material** and the grades will take care of themselves. Because + and - designations on letter grades carry numerical meaning at SCU, differences between one grade and another,e.g., an A- at 3.7 vs. a B+ at 3.3, are fairly small. This reduces the pressure on students and faculty.

CORE PATHWAY ENTRY COURSE:

This course serves as an entry course into the Values in Science, Technology, and Society Pathway within the 2009 University Core. If you choose to declare this pathway you may use a representative piece of work from Chem 11 in the Pathway Portfolio you will complete during your senior year. Please keep preferably electronic copies of your work (exams, lab reports, etc.) for this purpose.

STUDENT ATHLETES:

It is challenging to play a sport, with the time consuming practices and occasional traveling, and be successful in a subject as rigorous as chemistry. If you are an athlete, particularly in-season, please make prior arrangements with a classmate to obtain lecture notes, pickup handouts and pass along class announcements. Good planning really helps minimize the disruption of missing a class or two during the term.

ACADEMIC INTEGRITY:

Giving or receiving unauthorized aid in any form is not tolerated and can result in course failure. Academic dishonesty includes looking at another student's paper during an exam, allowing another student to copy off your paper, the use of lecture notes, crib sheets or textbooks during an exam, the inappropriate use of programmable calculators and the use of text messaging to communicate during exams. You may not wear earphones or ear buds during any exam or have a cell phone in your exam desk area. Please make academic integrity a high priority for yourself throughout your years here at SCU.

CHEMISTRY DEPARTMENT PERFORMANCE STANDARD:

This course is a prerequisite for Chemistry 12. In order to satisfy this prerequisite and enroll in any of Chem 12 sections this Winter, you must earn a grade of at least C- in Chemistry 11.

DISABILITY ACCOMMODATION POLICY:

To request academic accommodations for a disability, student must contact Disabilities Resources located in The Drahmann Center in Benson, Room 216, (408) 554-4111. Students must provide documentation of a disability to Disability Resources prior to receiving accommodations. If you feel you qualify for such an accommodation, please make an appointment with the staff at Disabilities Resources as soon as possible.

SOME IMPORTANT DATES:

Friday, October 15 - last day to withdraw from a course without a W appearing on transcript.
Friday, November 5 - last day to withdraw from a course; a W will appear on transcript.
Friday, December 3 - last day of classes
Wednesday, Dec. 8 - final exam – 9:10am-12:10pm in Kenna 308

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.

LECTURE SCHEDULE

DAY	DATE	CHAPTER	PAGES	TOPICS
M	SEPTEMBER 20	Introductory Remarks - Chapter 1		Chem in perspective, elements, compounds, mixtures.
W	SEPTEMBER 22	1	2-26	Chemistry basics: units, dimensional analysis, metric prefixes, significant figures in calculations
F	SEPTEMBER 24	2	36-49	Simple atomic structure, isotopes, atomic and mass numbers, atomic weights, intro to periodic table
M	SEPTEMBER 27	2	49-64	Molecular versus ionic compounds, predicting ion charges, naming ionic and binary molecular compds.
W	SEPTEMBER 29	3	78-96	Types of chemical reactions, writing chemical equations formula weights, intro to mole concept, Avogadro's #
F	OCTOBER 1	3	96-104	Determining empirical formula from analysis data. Empirical versus molecular formula
M	OCTOBER 4	3	104-109	Limiting reactant, theoretical yield and % yield
W	OCTOBER 6	3-4		Play catch up or look ahead
F	OCTOBER 8	4	120-130	Strong, weak and non-electrolytes; precipitation as an aqueous reaction driving force; solubility rules
M	OCTOBER 11	**EXAM I** (Chapters 1-3) Be sure to bring your calculator and check seating chart at the door		
W	OCTOBER 13	4	131-137	Acid/base reactions in double displacement.
F	OCTOBER 15	4	137-145	Intro. to redox, oxidation numbers, activity series
M	OCTOBER 18	4	146-156	Stoichiometry of reactions in aqueous solution
W	OCTOBER 20	5	166-172 182-187	Terms & definitions, specific heat, heat capacity and calorimetry
F	OCTOBER 22	5	169-173 187-195	Enthalpy changes, enthalpies of formation, Hess's Law
M	OCTOBER 25	6	216-223	Properties/quantization of radiant energy
W	OCTOBER 27	**EXAM II** (Chapters 4-5)		
F	OCTOBER 29	6	224-234	Atomic absorption/emission, Bohr atom, electrons as waves, quantum numbers, atomic orbitals
M	NOVEMBER 1	6	234-249	Orbital shapes and energies, electron configurations, core vs valence electrons
W	NOVEMBER 3	6-7	Catch up on last of 6 or have chance at more time for 7.	
F	NOVEMBER 5	7	260-276	Periodic properties: radius, ionization energy, and electron affinity
M	NOVEMBER 8	7	276-290	Chemistry of alkali and alkaline earth metals and the halogens
	(We may skip some of this descriptive chemistry)			
W	NOVEMBER 10	8	300-317	Ionic vs. covalent bonding, Lewis symbols, octet rule, ion sizes and electronegativity
F	NOVEMBER 12	8	317-325	Drawing Lewis structures, resonance concept, resonance structures and hybrids
M	NOVEMBER 15	8	325-334	Octet rule exceptions, bond length and strength
W	NOVEMBER 17	9	344-357	VSEPR theory and molecular geometry
F	NOVEMBER 19	**EXAM III** (Chapters 6, 7 and 8)		
	WEEK OF NOVEMBER 22 - THANKSGIVING HOLIDAY - NO CLASSES SCHEDULED			
M	NOVEMBER 29	9	357-360	Bond vs molecular polarity, dipole moment
W	DECEMBER 1	9	361-373	Atomic orbital hybridization, sigma vs pi bonds
F	DECEMBER 3	9	373-379	Intro to molecular orbitals (bonding vs antibonding), bond order, delocalization of electrons
		We will skip pages 371-381		

Final exam: Wednesday, December 9 from 9:10am – 12:10pm in Daly Science 206
Be sure to bring your calculator to the final exam.