CHEMISTRY 11 **SANTA CLARA UNIVERSITY**
GENERAL CHEMISTRY I **FALL TERM, 2010**

COURSE SYLLABUS

INSTRUCTOR: Dr. Alan Dafforn
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TIME AND PLACE: Daly Science 207 — MWF 8:00 am – 9:05 am — Section 60191

Daly Science 206 — MWF 10:30 am – 11:35 am — Section 60194

OFFICE HOURS: Office – Daly Science 204B

Times – Monday, Wednesday 12-1 pm; Friday 1-2 pm.

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

3) Laboratory Manual for General Chemistry 1, Fall 2010 Edition, SCU Department of Chemistry. Available at the bookstore.

4) For laboratory, a bound notebook with lined pages, preferably quadrille, 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 6-8 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. It is helpful to skim the reading once before class, then re-read it carefully after class along with your notes to solidify your understanding of details.

-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 Powerpoints as a substantial part of preparing for exams.
- some people find it useful to print out the Powerpoint slides before lecture.

-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"?

-It is essential to keep up. Chemistry is one of those subjects that is best learned a bit at a time and requires consistent practice in problem solving. Waiting until the proverbial "night before the exam" to study chemistry simply does not 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 make homework assignments from textbook chapters as we move along through the course, and may give additional problems 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 a visit to me during office hours is called for.

An Additional Note about the Study Guide and Problem Solving.

We have found that many students truncate the learning process by doing the problems *with* the study guide instead of consulting it only when they have questions. The best approach is to challenge yourself to work the problem a number of times before consulting the guide for assistance. Force yourself to review the lecture material and develop your problem-solving skills and tenacity at working the problems. If you cannot come up with a reasonable answer to a problem consult the study guide for the answer only! Then try to rework the problem to achieve the right answer. Also, for hints on solving the problems see me or a fellow student, but ask for only enough information to get you started on the problem. This process will improve your ability to work the problems independently and will more accurately represent your progress. Development of strong problem-solving skills is a main goal of this course and essential to your future success in science.

ASSESSMENT:

1) Midterm exams - 3 of them (1 hour each) - see lecture schedule for approximate dates
2) Final exam - 8 am class: Monday, December 6 from 9:10 am to 12:10 pm
   10:30 am class: Friday December 10 from 9:10 am to 12:10 pm.
3) Laboratory performance - contributes a small amount toward course grade

GRADING:

3 exams at 150 points each	= 450 points
Final exam	= 200 points
Laboratory	= variable*
Total points	= ~650 points

Grades will be based largely on your performance on the 3 exams (150 points each) and the final exam (200 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.

Makeup midterms will be given only in exceptional cases and at the discretion of the instructor. Please note that University policy mandates that final exams cannot be given at times other than those set by the registrar (i.e., please try not to plan a Caribbean cruise starting Wednesday of finals week if you have a final on Friday).

Letter grades are based on how I feel the class has done relative to the difficulty of the exams and are based on a curve. Following departmental guidelines, however, approximately 40% of the class will receive grades of B- or higher, and approximately 60% of the class will receive grades of C+ or lower. 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.

LABORATORY DRESS CODE

Please note that the following dress code has been established for all students, staff, and faculty in chemistry department laboratories:

- A "t-shirt" is the minimum coverage of the upper body that is acceptable
- Long pants are required
- Closed-toe shoes, ideally with a non-permeable upper component covering the foot, are required
- Safety goggles are required. These can be purchased in the first week of classes before your lab for $15. The cost increases to $20 later in the quarter.
- Failure to meet these requirements will result in a student having to leave the laboratory until such time as any deficiencies have been addressed.

ERes AND EMAIL.

We will use ERes extensively to post Powerpoints and occasionally for other information. The page may be accessed at http://eres.scu.edu; the password is chem11. It may also be necessary to send announcements to the class by email. You are expected to have an active GroupWise Email account and to check it regularly. If you use an alternative email account, please make sure to let me know.

PEER TUTORING:

Drop-in peer tutoring will be available during the quarter. Details will be provided later.

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 and pass along class announcements.

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. 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 Chem 12 sections this Winter, you must earn a grade of at least C- in Chemistry 11. If you do not meet that standard, it is your responsibility not to enroll or to withdraw from pre-enrollment in Chemistry 12. If you enroll for a course for which you do not qualify, you are subject to Administrative Withdrawal on the first day of class.

DISABILITY ACCOMMODATION POLICY:

To request academic accommodations for a disability, the student must contact Disabilities Resources located in The Drahmann Center in Benson, Room 214, (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.

CORE

This course fulfills the Natural Science requirement of both the "old" core and the "new" core (a component of "Explorations"). In addition, this course is associated with the Values in Science & Technology pathway of the new core. If you declare a Pathway in this area you may use a representative piece of work from this course in the Pathway Portfolio you will complete during your senior year. Recommendation: Keep copies of your work, including graded laboratory reports.

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.

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.
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	6	224-234	Atomic absorption/emission, Bohr atom, electrons as waves, quantum numbers, atomic orbitals
F	OCTOBER 29	6	234-249	Orbital shapes and energies, electron configurations, core vs valence electrons
M	NOVEMBER 1	**EXAM II**		
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),
		We will skip pages 376-386		bond order, delocalization of electrons

Final exam: 8 am section: Monday, December 6 from 9:10 am – 12:10 pm – DS207
10:30 am section: Friday December 10 from 9:10 am to 12:10 pm- DS206
Be sure to bring your calculator to the final exam.

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.