CHEMISTRY 11 **SANTA CLARA UNIVERSITY**
GENERAL CHEMISTRY I **SUMMER TERM, 2017**

COURSE SYLLABUS

INSTRUCTOR: Dr. Steven L. Fedder
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TIME AND PLACE: Alumni Science 120
MTWRF –9:00am - noon

OFFICE HOURS: Office – DS104

Times – Monday thru Friday, 1:00-2:00pm, Daly Science 104

Other times may be possible by arrangement, including briefly after each class

REQUIRED MATERIALS:

1) Chemistry, the Central Science, 13th Edition, by Brown, Lemay and Bursten, Prentice/Hall, Inc. This comes shrink wrapped with a solutions manual and an access code for the Mastering Chemistry on-line package.

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, a "lab packet" and a lab coat are required. In addition, safety goggles are required and will be made available for sale by the Chemistry Club during the first week 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 5-7 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. Most of these assigned problems are numbered in red at the end of each chapter. The Study Guide/Solutions Manual that comes shrink-wrapped with your text is available to give you feedback on the red numbered homework problems. If you want more practice you can do some of the black numbered homework problems in the back of each chapter as well. Solutions to these will be posted in a long glass showcase in the breezeway between the DS 100 and DS200 buildings……..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. I will also be incorporating some suggested work from the Mastering Chemistry product which accompanies your textbook package. If you feel you want additional or alternative explanations regarding certain topics you may want to investigate the free offerings from Khan Academy on the Web.

ASSESSMENT:

1) Midterm exams - 2 of them (hour long w/ assigned seats) - see lecture schedule for approximate dates
2) Final exam - Friday, July 1 during usual class time – all three hours allotted.
3) Laboratory performance - contributes a small amount toward course grade. **See lab discussion below.**

GRADING:

2 exams at 150 points each	= 300 points
Final exam	= 250 points
Laboratory	= pass/fail*
Total points	= ~550 points

Grades will be based largely on your performance on the 2 exams (150 points each) and the final exam (250 points). *Your grade is also influenced by your performance in the laboratory; see lab discussion below.

***LABORATORY PROCEDURES*:**

You must successfully complete and pass the laboratory section of the course in order to pass the class. 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 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. IN ADDITION, A DEDUCTION OF 1% WILL BE MADE FROM YOUR LECTURE TOTAL IF YOU HAVE AN UNEXCUSED ABSENCE FROM LAB.

(2) The final course grade in Chemistry 11 will be determined by your accumulated points in lecture only since lab is pass/no pass. However, as an added incentive to do your very best in lab, points will be added to or deducted from your lecture total according to the following schedule:

Lab "grade" earned	How this influences your overall course grade .
High Pass	A bonus equal to 2% will be added to your lecture point total
Pass	A bonus equal to 1% will be added to your lecture point total
Low Pass	No change in lecture point total
Fail	Failure in the entire course

COURSE LETTER GRADE:

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**. Try to make the paradigm shift from points and grades to learning as deliberately as you can in your transition from high school to college.**

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. You can find information about Pathways on the Core Curriculum website http://scu.edu/core including specific Pathways, all courses associated with them, and the Reflection Essay prompt and rubric used to evaluate the final essay you will submit. http://www.scu.edu/provost/ugst/core/pathways/resources/. So be sure to save your work for from class to use in your reflection essay.

If you declare this Pathway, you may use a representative piece of work from this course as one of the Pathway materials you will upload via eCampus during your junior or senior year. Therefore, we recommend that you keep electronic copies of your work using Dropbox or Google Docs, in addition to saving copies on your own computer or flash drives. This may ensure you will have a range of choices for retrieving your saved files when you analyze and assemble your Pathway materials in preparation to write the Pathway reflection essay.

CORE NATURAL SCIENCE WITH LAB FULFILLMENT:

One might assume that any lab science course has been approved to meet the Core Curriculum requirement for a natural science with lab course, but many do not. Chemistry 11 has been approved for that requirement and therefore meets it via the learning goals noted here. Students will

1) Demonstrate a basic understanding of the theory and concepts central to the study of a particular topic or discipline in the natural sciences.
2) Apply scientific reasoning and methods of inquiry, such a formulating testable hypotheses, designing informative experiments, or collecting experimental or observational dtes than explain phenomena in the natural world.
3) Interpret scientific data qualitatively and quantitatively, in order to derive conclusions consistent with the scope and quality of the data.
4) Recognize limitations of experimental and observational methods, and understand concepts of probability, causation and correlation.

SEXUAL HARASSMENT AND DISCRIMINIATION (Title IX)

Santa Clara University upholds a zero tolerance policy for discrimination, harassment and sexual misconduct. If you (or someone you know) have experienced discrimination or harassment, including sexual assault, domestic and dating violence or stalking, I encourage you to tell someone promptly. For more information, please go to www.scu.edu/studentlife/about/osl.cfm and click on the link for the University's Gender-Based Discrimination and Sexual Misconduct Policy or contact the University's EEO and Title IX Coordinator, Belinda Guthrie, at 408-554-3043 or by email at bguthrie@scu.edu. Reports may be submitted online through www.scu.edu/osl/report or anonymously through Ethicspoint: www.ethicspoint.com or http://stage-www.scu.edu/hr/quick-links/ethics-point

DISABILITIES RESOURCES

If you have a disability for which accommodations may be required in this class, please contact Disabilities Resources, Benson 216, http://www.scu.edu/disabilities as soon as possible to discuss your needs and register for accommodations with the University. If you have already arranged accommodations through Disabilities Resources, please discuss them with me during my office

hours. Students who have medical needs related to pregnancy or parenting may also be eligible for accommodations.

While I am happy to assist you, I am unable to provide accommodations until I have received verification from Disabilities Resources. The Disabilities Resources office will work with students and faculty to arrange proctored exams for students whose accommodations include double time for exams and/or assisted technology. (Students with approved accommodations of time-and-a-half should talk with me as soon as possible). Disabilities Resources must be contacted in advance to schedule proctored examinations or to arrange other accommodations. The Disabilities Resources office would be grateful for advance notice of at least two weeks. For more information you may contact Disabilities Resources at 408-554-4109.

***ACADEMIC INTEGRITY PLEDGE*:** Santa Clara University is implementing an Academic Integrity pledge designed to deepen the understanding of and commitment to honesty and academic integrity.

The Academic Integrity Pledge states:

> "I am committed to being a person of integrity. I pledge, as a member of the Santa Clara University community, to abide by and uphold the standards of academic integrity contained in the Student Conduct Code."

I ask that you affirm this pledge and apply these principles to your work in this class.

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 Chem 12 (General Chemistry II). In order to satisfy the prerequisite and be eligible to enroll in Chem 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.

SOME IMPORTANT DATES:

Tuesday, June 20 – last day to withdraw from course with 100% tuition refund
Wednesday, June 21 - last day to withdraw from course without a W appearing on transcript
Wednesday, June 21 – last day to withdraw from course with a 50% tuition refund
Friday, June 30 – last day to withdraw from course; a W will appear on transcript
Friday, July 7 - final exam from 9:00am – noon in Alumni Science 120

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

Note: We may cover material at a slightly faster pace than this; treat this as a rough calendar. I'll be more specific at the end of each class as we move through the course.

DAY	DATE	CHAPTER	PAGES	TOPICS
M	JUNE 19	Introductory Remarks - Chapter 1		Chem in perspective, elements, compounds, mixtures.
		1	1-31	Chemistry basics: units, dimensional analysis, metric prefixes, significant figures in calculations
T	JUNE 20	2	38-68	Simple atomic structure, isotopes, atomic and mass numbers, atomic weights, intro to periodic table Molecular versus ionic compounds, predicting ion charges, naming ionic and binary molecular compds
W	JUNE 21	3	76-99	Types of chemical reactions, writing chemical equations formula weights, intro to mole concept, Avogadro's # Determining empirical formula from analysis data. Empirical versus molecular formula
R	JUNE 22	3	99-104	Limiting reactant, theoretical yield and % yield
F	JUNE 23	4	114-124	Strong, weak and non-electrolytes. Precipitation as an aqueous reaction driving force. Solubility rules for ionic compounds in water.
		Ah, the weekend!!		
M	JUNE 26	EXAM I (CHAPTERS 1-3)		Weak/non-electrolyte formation as a driving force.
		4	124-130	
T	JUNE 27	4	131-149	Molarity as a concentration unit; solution stoichiometry Intro to redox via the activity series of metals
W	JUNE 28	5	158-172	Thermodynamic terminology and perspective
			175-180	Specific heat, heat capacity and calorimetry
R	JUNE 29	5	169-175	Enthalpy changes, enthalpies of formation
			181-187	Hess's Law
F	JUNE 30	6	206-222	Properties/quantization of radiant energy Atomic absorption/emission, Bohr atom, electrons as waves, quantum numbers, atomic orbitals
		Ah, the weekend!		
M	JULY 3	EXAM II (CHAPTERS 4-5 AND ELECTROMAGNETIC RADIATION)		
		6	222-238	Orbital shapes and energies, electron configurations, core vs valence electrons
T	JULY 4	7,8	248-264	Periodic trends in IE, EA, etc, related to binary ionic compound formation and the Born/Haber cycle
W	JULY 5	8,9	288-321	Lewis symbols, octet rule, ion sizes and electronegativity Drawing Lewis structures, resonance concept, formal charge as a tool. VSESR theory
R	JULY 6	9	330-364	Bond vs molecular polarity, dipole moment Atomic orbital hybridization, sigma vs pi bonds Intro to molecular orbitals (bonding vs antibonding), bond order, delocalization of electrons
F	JULY 7	FINAL EXAM (CHAPTERS 1-9)		