Spring 2010 — Chem 192 CRN 42025
Cañada College

Class Syllabus

Elementary Chemistry 192

Elementary Chemistry will be taught from 1/19/2010 through 5/20/2010. The instructor is Dr. Nick DeMello (email **192@chemlectures.com**). The Chemistry website for 192 is located at **http://chem.ws/192** (syllabus, schedule, homework assignments, labs, and study guides may be downloaded from the website).

Course Description:

This is a comprehensive introductory chemistry course covering basic concepts, theories and laws with emphasis on reasoning and problem-solving skills. Topics include but are not limited to chemical nomenclature, stoichiometry, electron configuration, atomic orbitals, molecular geometry and bonding. The laboratory component of this course introduces students to both qualitative techniques and quantitative techniques appropriate for data collection, manipulation and analysis of a variety of chemical systems.

Required Materials:

- Textbook: Hein, M., Arena, S. Foundations of College Chemistry, 12th Ed., Wiley.
- Laboratory Manual: Chemistry 192 Laboratory Manual, Cañada College
- Laboratory Safety Goggles
- Simple Scientific Calculator *(Cell phones, PDA's, and other personal electronic devices are not allowed during exams or quizzes. Graphing calculators are not needed and discouraged but may be allowed.)*

Prerequisites:

- Math 110 (or equivalent): Chemistry is a math-intensive subject and requires basic algebra.
- Reading 836
- English 836 or 400

Dates & Times:

- **Lecture** will be held from 9:45am to 11:00am Tuesdays & Thursdays, in room 0319 building 18. Lecture attendance is required. You must sign the daily lecture attendance sheet. Students missing more than three consecutive lectures, more than six lectures in total, or more than two lectures before Sept 1st, may be dropped from the class.
- **Laboratory** section will be held from 11:10am to 12:25pm Tuesdays & Thursdays in room 0305 building 18. Lab attendance is required. You must sign the daily lab attendance sheet. There are 15 lab assignments this semester (subject to change), some of which may span two lab periods. There are **no** make-up labs. Lab assignments cannot be completed or submitted without attending the corresponding lab section or sections. Your lowest two lab scores will be dropped to allow for unavoidable absences or unrecoverable experimental problems.
- **Study Group** will be offered in the Student Learning Center, room 251-B or C (in back near MESA area) Thursdays 12:30 to 1:30pm. (Other sessions may be offered.) In Study Group, you will be guided through example problems from homework, exams, and other sources. Students are **required** to participate in a **total of 16 hours** of Study Group. Attendance will be monitored using the Learning Center kiosk. Students are also encouraged to form smaller study groups that meet in the Learning Center where learning center staff and chemistry tutors are available. Up to 50% of class Study Group attendance may be made up by participating in student-formed study groups meeting in the learning center. (Remember to sign in at the Learning Center kiosk.)
- **Midterm Exams (4)** will be held during lab period on Thur Feb 11th; Thur Mar 4th; Thur Apr 1st; and Thur May 6th. There are **no** make-up exams. Exams cannot be taken early. Review sessions will be held in the last lab period before the exam date.
- The **Final Exam** will be from 8:10am to 10:40am Tue, May 25th. The final exam will be comprehensive. There are **no** make-up exams. The exam cannot be taken early. The final exam is required to receive a passing grade in the course.

Assignments

Reading:

Lectures will parallel the content in the class textbook. Prior to lecture, students are required to read the assigned textbook through the section indicated on the course schedule for that day. A notepad is recommended while reading to write down any questions that occur to you for discussion in lecture or study group. Take particular note of definitions and formulas introduced in the text. The lecture will assume students have read the assigned sections.

Homework:

Homework problems will be assigned for each chapter. Homework assignments will include questions and calculations similar to those found on the midterms and final exam. Homework assignments will be handed out at the end of lecture or may be downloaded from the class website. There are 14 homework assignments. Homework assignments are due at the start of lecture on the date indicated on the class schedule. Late homework assignments may be turned in for partial credit.

Additional suggested problems from the questions section of each chapter will be listed on each homework assignment. Suggested problems are not required and will not be graded, but are recommended. The answer to suggested problems are available at the back of your textbook. Suggested problems and their solutions will be discussed in the Study Group section.

Laboratory:

Students will work in pairs or groups of four, depending on the lab. Each student pair will have an assigned lab drawer for the semester and will be responsible for the equipment contained in their drawer. Partners must cooperate to execute the lab experiments. However, each student must turn in their own assignment with all data, graphs, and printouts. (Always make a separate printout for each team member.)

Students are required to view a safety video detailing the college's safety policies and achieve a passing grade on the subsequent safety quiz before conducting any experiments. Students who disregard laboratory safety policies at any time in the semester may be asked to leave the lab and therefore, earn no points for that lab. At the instructor's discretion, 5 points may be deducted from your safety quiz score as a warning instead.

Students are required to read through each experiment and complete any pre-lab work before entering the laboratory. Lab assignments are due at the start of the lab period following completion of the experiment. The total possible score for each experiment is 15 points (typically 5 points for pre-lab questions or a pre-lab quiz and 10 points for the lab report). There are **no** make-up labs. Students may submit lab work only for labs they attended and participated. Missed labs will result in **zero** points. The lowest two lab scores will be dropped. Late lab reports may be turned in for partial credit.

Exams:

There are four midterm exams (150 points each) and a final exam (200 points). Students are required to bring a scientific calculator, pencils (2), and an eraser to each exam. No scantron forms or blue books are required. There are **no** make-up exams. Exams cannot be taken early. A missed midterm exam will result in zero points for that exam. Only the three highest midterm exam grades will be counted in the final total. The midterm exam with the lowest score will be dropped. The final exam is comprehensive and is required. **Not taking the final exam will result in a failing grade for the course**.

Grading

Grades are based on a straight percentage of total points achieved to total points possible. Chemistry 192 is not graded on a curve. Students who earn 90% or more of the available points (expected to be 900 or more points) will receive an A grade. Students who earn less than 90% but more than 80% (expected range of 800-899 points) will receive a B grade. Students who earn less than 80% but more than 70% (expected range of 700-799 points) will receive a C grade. Students who earn between 70% and 55% (expected range of 550-699 points) will receive a D grade.

The grade will be based on an expected total of 1000 points. There is no extra credit. Roughly 1/3 of the points possible will be from homework and lab assignments; the other 2/3 of points possible will be from exams.

45%	Midterm Exams (150 pts each; lowest score will be dropped)	450 pts
20%	Final Exam	200 pts
14%	Homework (10 pts each, 14 assignments)	140 pts
19½%	Lab Assignments (15 pts each; lowest two scores will be dropped)	195 pts
1½%	Lab Safety Quiz (less 5 pts per safety warning)	15 pts
	Total	1,000 pts

Course Outline

The following is a list of important goals for students taking Chemistry 192, broken down by chapters in the course textbook (Foundations of Chemistry 12th Ed by Hein and Arena). Exams and assignments will focus on helping students achieve these goals. Additional goals may be added during the semester and not all goals will be tested for on any given exam or assignment. Students are encouraged to use this course outline as a baseline for reviewing chapters, preparing for exams, and determining if Chemistry 192 meets the student's personal objectives in studying chemistry.

Ch 1 — Introducing Chemistry

- ☐ Understand the definitions of chemistry and matter.
- ☐ Apply the scientific method.
- ☐ Differentiate between and give examples of a scientific law, hypothesis, observation, and theory.
- ☐ Understand the particle model of matter.
- ☐ Recognize and give examples of three states of matter.
- ☐ Understand matter can be classified as substance, mixture, compound, elements, homogeneous and heterogeneous.
- ☐ Understand the differences between the three states of matter.
- ☐ Be able to differentiate between pure substances and mixtures.
- ☐ Be able to identify homogenous and heterogeneous matter.

Ch 2 — Standards for Measurement

- ☐ Be able to use scientific notation to express numbers.
- ☐ Understand what a measurement is and show the uncertainty.
- ☐ Recognize the significant figures in a measurement. (SLO 1)
- ☐ Identify exact numbers including definitions and counting numbers.
- ☐ Carry the correct significant figures through a multiplication or division.
- ☐ Carry the correct significant figures through an addition or subtraction.
- ☐ Be able to apply dimensional analysis to problem solving.
- ☐ Use dimensional analysis to convert between units in the metric system.
- ☐ Understand precision and accuracy in measurements.
- ☐ Take measurements and solve conversion problems for mass, volume, and temp.
- ☐ Understand the concept of density.
- ☐ Calculate the density of matter and solve problems using the density equation.

Ch 3 — Elements & Compounds

- ☐ Understand that all matter in the universe is composed of about 100 elements.
- ☐ Recognize the difference between compounds and elements.
- ☐ Identify metals, metalloids, and non-metal elements using a periodic table.
- ☐ Recognize properties of metals, metalloids, and non-metal elements.
- ☐ Know which elements exist as diatomic or polyatomic molecules.
- ☐ Interpret chemical formulas.
- ☐ Understand what each symbol in a chemical formula means.

Ch 4 — Properties of Matter

- ☐ Identify when an observation or measurement is a property of a substance.
- ☐ Understand how properties can be used to identify substances.
- ☐ Be able to distinguish between chemical and physical properties. (SLO 2)
- ☐ Know the difference between a chemical and physical change.
- ☐ Understand and apply the law of conservation of matter.
- ☐ Identify different forms of energy.
- ☐ Recognize whether an example of energy is potential or kinetic.
- ☐ Understand and apply the law of conservation of energy.
- ☐ Know the difference between heat and temperature.
- ☐ Understand the roll of heat in the particle theory of matter.
- ☐ Understand the concepts of specific heat and heat capacity.
- ☐ Calculate the specific heat of a substance. (SLO 3)
- ☐ Solve problems using the specific heat equation.

Ch 5 — Early Atomic Theory

☐ Know the contributions of Democritus, Empedocles, and Aristotle to atomic theory.
☐ Know how John Dalton advanced atomic theory.
☐ Understand the law of definite composition and reconcile it with atomic theory.
☐ Understand the law of multiple proportions and reconcile it with atomic theory.
☐ Know the properties of electric charge.
☐ Know Michael Faraday's contribution to the theory of ions.
☐ Understand the difference between an ion and an atom.
☐ Understand J. J. Thomson's contribution to understanding subatomic particles.
☐ Be able to name the three major subatomic particles.
☐ Know the relative mass and charge of the subatomic particles.
☐ Know the Thomson model of the atom and how it explains the existence of ions.
☐ Understand Rutherford's experiment with gold foil.
☐ Explain how Rutherford's experiment established nuclear theory.
☐ Understand the physical significance of atomic number.
☐ Understand how atoms of the same element may be different isotopes.
☐ Be able to write and interpret isotopic notation of different atoms and ions.
☐ Know how an AMU is defined.
☐ Calculate the average atomic mass of an element.

Ch 6 — Nomenclature of Inorganic Compounds

☐ Be able to identify an element, a binary compound, and a polyatomic compound.
☐ Write the name of elements and ions given their molecular formula.
☐ Write the molecular formula of elements and ions.
☐ Understand the two basic rules for naming an ionic compound.
☐ Be able to write the formula for any ionic compound, given its name.
☐ Name a binary compound that contains a metal forming only one type of cation.
☐ Name a binary compound with a metal that can form 2 or more types of cation.
☐ Name a binary compound that contains two non-metals.
☐ Name a binary compound derived from an acid.
☐ Name a binary compound that is an acid.
☐ Name a polyatomic ion (table 6.6 and all halogen oxy-anions like those in table 6.7)
☐ Name a polyatomic compound.
☐ Name a polyatomic acid.

Ch 7 — Quantitative Composition

☐ Know Avogadro's number.
☐ Understand the concept of a mole.
☐ Using a periodic table, show the atomic mass and the molar mass of each element.
☐ Calculate the number of atoms or molecules of a mass of a given element.
☐ Calculate the mass of a number of molecules or atoms of a given element.
☐ Determine the molar mass of a compound from its formula.
☐ Use the molar mass to relate the number of moles of a compound to it's mass.
☐ Calculate the theoretical percent composition of a compound form it's formula.
☐ Calculate experimental percent composition of a compound from experimental data.
☐ Understand the difference between an empirical formula and a molecular formula.
☐ Calculate an empirical formula from the percent composition of a sample.
☐ Calculate the molecular formula from an empirical formula and a molar mass.

Ch 8 — Chemical Equations Introduced

☐ Understand the symbols used in a chemical equation.
☐ Translate a description of a chemical reaction into a chemical equation.
☐ Interpret a chemical equation to describe a chemical reaction.
☐ Balance a chemical equation.
☐ Identify combination, decomposition, single displacement, and double displacement types of reaction.
☐ Predict possible products or reactants in different types of reaction.

☐ Identify reactions as endothermic or exothermic based on changes in heat.
☐ Identify the heat of reaction and the heat of activation in a reaction coordinate diagram.

Ch 9 — Chemical Equation Calculations

☐ Understand the definition of stoichiometry.
☐ Be able to find the mole ratio between any two participants in a balanced equation.
☐ Use a balanced equation to solve mole-mole word problems.
☐ Use a balanced equation to solve mole-mass word problems.
☐ Use a balanced equation to solve mass-mass word problems.
☐ Identify the limiting reactant in a given reaction.
☐ Calculate the theoretical yield of a reaction, using the concept of limiting reactants.
☐ Calculate the percent yield of a reaction, from the theoretical and experimental yield.

Ch 10 — Modern Atomic Theory

☐ Understand how the Bohr atomic model explained line spectrum.
☐ Understand de Broglie's contribution to quantum theory.
☐ Describe how Schrödinger explained principle energy levels using wave mechanics.
☐ Be able to identify the number of s, p, d, and f sublevels for each primary energy level.
☐ Recognize the orbital shapes associated with each energy level and sublevel.
☐ Be able to draw the relative orbital shape and size for s and p orbitals.
☐ Apply the Pauli exclusion principle to populating orbitals.
☐ Know the common name of groups and families of elements.
☐ Be able to read and draw ground state orbital diagrams for elements and ions.
☐ Be able to read and write ground state electron configurations for elements and ions.
☐ Understand how to use noble gas cores in electron configuration notation.
☐ Identify the valence electrons in electron configurations.
☐ Explain why elements in the same group or family have similar chemical behavior.

Ch 11 — Chemical Bonds

☐ Understand trends in the periodic table for ionization energy and electron affinity.
☐ Predict how atomic radius changes as you move across or down the periodic table.
☐ Be able to draw Lewis dot symbols for neutral elements and ions.
☐ Understand how ions are formed.
☐ Understand how ions combine to make an ionic solid.
☐ Predict the formula of an ionic solid, based on its electronic configuration.
☐ Know whether an ion is larger or smaller than a neutral atom of that element.
☐ Understand how covalent bonds are formed.
☐ Predict the structure of a molecule based on the Lewis dot structure of it's atoms.
☐ Understand how electronegativity changes moving across or down the periodic table.
☐ Use electronegativity values to predict whether a bond is ionic or covalent.
☐ Understand the difference between purely covalent and ionic covalent bonds.
☐ Be able to draw dipoles along bonds in a molecule.
☐ Be able to construct the Lewis dot structure of a molecule.
☐ Use VSEPR to predict the electronic shape around an atom (shape of electron sets).
☐ Use VSEPR to predict the molecular shape around an atom (shape of connected atoms).
☐ Be able to predict whether a molecule is polar or non-polar.

Ch 12 — The Gas State of Matter

☐ Know the six principle assumptions of the KMT.
☐ Know the equation for kinetic energy.
☐ Understand how the KMT explains the pressure of a gas.
☐ Be able to convert between units of pressure (atm, torr, mmHg).
☐ Understand how a barometer works.
☐ Predict how changing the number of atoms, temperature, or volume effects pressure.
☐ Be able to apply Boyle's law (PV=k) to solve pressure-volume problems.
☐ Be able to apply Charles' law (V=kT) to solve temperature-volume problems.
☐ Be able to apply Gay-Lussac's law (P=kT) to solve pressure-temperature problems.
☐ Apply the combined gas law to solve pressure-volume-temperature problems.

☐ Know Dalton's law of partial pressures.
☐ Use Dalton's law of partial pressures to solve vapor pressure problems.
☐ Know Avogadro's law.
☐ Use molar volume (1 mol=22.4 L) to solve mole-mass-volume problems.
☐ Know STP (standard temperature and pressure).
☐ Know the ideal gas constant (R=0.0821 L•atm / mol•K)
☐ Apply the ideal gas law (PV=nRT) to solve for pressure, temperature, volume, or number of molecules in an ideal gas.

Some select topics from these chapters will also be discussed:

Ch 13 — Properties of Liquids

☐ Understand the processes of vaporization, sublimation, and condensation.
☐ Understand vapor pressure in the context of liquid to gas equilibrium.
☐ Understand the phenomena of surface tension and how it contributes to capillary action and meniscus formation.
☐ Know what the freezing point and melting point represent.
☐ Calculate the heat necessary to melt a sample at it's melting point, using heat of fusion.
☐ Calculate the heat necessary to vaporize a sample at it's boiling point, using the heat of vaporization.
☐ Understand the hydrogen bond and be able to explain why it affects melting point and boiling point.

Ch 14 — Solutions

☐ Be able to apply the terms solute and solvent.
☐ Understand the effect of temperature and pressure on solubility.
☐ Be able to interpret solubility curves to predict whether a solution is saturated.
☐ Understand the concept of molarity.
☐ Solve problems that involve relating volume, molarity, and number of moles.
☐ Calculate resulting molarity of each ion from mixing two or more solutions of ions.

Ch 15 — Acids & Bases

☐ Know the most common physical and chemical properties of acids and bases.
☐ Know the criteria for a Arrhenius acid and base.
☐ Know the criteria for a Brønsted-Lowry acid and base.
☐ Know the criteria for a Lewis acid and base.
☐ Be able to identify electrolytes and non-electrolytes.
☐ Calculate the acidity (concentration of [H+]) in a solution from masses of strong acids and volume of solvent.
☐ Calculate the pH of a solution from [H+].
☐ Calculate the molarity of [H+] from pH.
☐ Calculate the resulting molarity of a solution from mixing two solutions of strong acids.
☐ Calculate the resulting molarity of a solution from mixing a strong acid and strong base solution.