

CHEM 1210 – Principles of Chemistry I

Syllabus

Instructor: Dr. Shawn M. Miller

Fall Term, 2019

Email: shawn.miller@usu.edu

Office Hours: Monday/Wednesday

11:30 AM – 12:30 PM in Widtsoe 339

Course Lecture/Recitation Times & Locations:

Section (CRN)	Time	Day	Location
Lecture 004 (42807)	9:30 AM to 10:20 AM	M/W/F	Life Science Building 133
Recitation 524 (42810)	1:30 PM to 2:20 PM	M	Eccles Business Building 216
Recitation 525 (42811)	7:30 AM to 8:20 AM	T	Eccles Business Building 214
Recitation 526 (42812)	11:30 AM to 12:20 PM	W	Huntsman Hall 130
Recitation 527 (42813)	8:30 AM to 9:20 AM	F	Huntsman Hall 130

Prerequisite:

One of the following:

- Math ACT score of at least 25 or equivalent SAT Math score
- AP Calculus AB score of 3 or higher
- ALEKS Math score of 76 or higher
- MATH 1050 or higher (may be taken concurrently)

High school chemistry recommended

Required Materials:

Text: Brown, LeMay, Bursten, Murphy, Woodward, Stoltzfus *Chemistry: The Central Science*, 13th ed.; Pearson Education, Inc. (ISBN: 978-0-321-91041-7)
(earlier editions are fine)

Calculator: A non-programmable scientific calculator is recommended for use in Lecture and on Exams. Programmable calculators are permitted during Exams only if their memory is cleared by the Testing Center. Other electronic devices, including phones, are not permitted during Exams.

Optional Materials:

iclicker: iclicker 2s are used during the Lecture period and extra credit is awarded through the use of iclickers. iclickers must be registered by the beginning of class. To register an iclicker, use the link in the navigation sidebar on Canvas.

Supplementary Course Assistance:

This course provides an SI and UTF in addition to the course Teaching Assistants (TAs) to provide supplementary assistance to the main Lecture period and instructor Office Hours. Attending these sessions are completely optional, but you are strongly encouraged to make use of these resources.

SI Information: Saul Gonzalez (contact: saulgonzalez10@aggiemail.usu.edu or Canvas)

Session Times: Tuesday 7:30 PM – 8:20 PM in ENGR 302

Thursday 6:30 PM – 7:20 PM in ENGR 302

UTF Information: Jacob Andersen (contact: jacob879@hotmail.com or Canvas)

Session Times: Monday and Wednesday 4:00 PM – 4:50 PM in EBB 218

TA Information: Spencer Slaugh (contact: spencerslaugh7@gmail.com or Canvas)

Recitations: Monday

Mark Gold (contact: markgold13005@gmail.com or Canvas)

Recitations: Tuesday, Wednesday, Thursday

Course Overview

CHEM 1210 is the first semester in a two-semester series of general chemistry courses that is targeted towards science and engineering students that meets three times a week. Lectures will include both presentation of content and practice problems. Recitations will be held once a week for additional practice with course material. There will be an online Post-Chapter Quiz for each chapter section designed to help prepare students for the Exams. There will be three 60-minute Midterm Exams in addition to a 120-minute Final Exam all of which will be proctored on Canvas via the Testing Center.

Course Learning Objectives

CHEM 1210 is a course designed to introduce you to the fundamentals of general chemistry that you will continue to pursue in CHEM 1220. By reading the textbook prior to the Lecture period, you will obtain a basic understanding of the upcoming Lectures' topics. By attending, taking notes during, and asking questions during Lecture periods, you will expand and refine your understanding of the course material. You will demonstrate proficiency with the course material through in-Lecture clicker questions, in-Lecture practice problems, and online Canvas Quizzes. You will demonstrate mastery of the course material through three midterm Exams and a Final Exam.

By the end of this course, you will be able to...

- ...describe science as a process for discovery.
- ...list key fundamental chemistry theories and principles.
- ...use fundamental chemistry theories and principles to explain or predict a result when presented with a chemistry scenario.
- ...identify and use the appropriate equation(s) and problem-solving tool(s) needed to solve a chemistry problem.

- ...calculate and correctly write scientific values using algebra and other fundamental mathematical skills.
- ...answer conceptual chemistry questions using short-form writing.

A detailed set of Learning Objectives for each chapter is located at the end of this syllabus.

You will prepare for and practice achieving these objectives by...

- ...reading the textbook while taking notes.
- ...attending and taking notes during Lecture periods.
- ...attending and participating in weekly Recitation sections.
- ...taking graded online Canvas Chapter Quizzes.
- ...reviewing your performance on the Post-week Quizzes.
- ...asking for help via Office Hours, Piazza, Canvas message, or e-mail.
- ...completing Chem101 homework problems online.
- ...optionally attending UTF or SI sessions for problem solving and further assistance.

You will be assessed on how you have achieved these objectives using...

- ... one Getting Started Quiz on Canvas.
- ...the aforementioned Recitation sections.
- ... the aforementioned Quizzes on Canvas.
- ...three Midterm Exams.
- ...one Final Exam.

Course Communication

Piazza is the recommended venue for asking academic questions about the course. Piazza is a free online system that can be accessed directly through Canvas designed for students to have access to rapid and efficient help from classmates, TAs, and the instructor simultaneously. **Piazza is not to be used to convey personal information.** Contact the instructor directly if you need to discuss personal information such as grades.

When you post a question on Piazza, the instructor, the UTF, the SI, the TAs, and your fellow students can all answer the question making it more likely for you to receive a rapid response compared to emailing one person and hoping they read it soon. Maybe you'll even get lucky and someone will have already asked the question you were going to ask and got it answered! You have the option of posting anonymously to each other, but the instructor will always be able to see your identity. Enroll in the course by clicking on the "Piazza" link in the sidebar on Canvas and following the instructions there. 2 extra credit points will be awarded to all students who enroll in Piazza regardless of their use of the service provided they enroll by 11:00 PM on the Friday in Week 1 of the term.

You are always welcome to message the instructor with questions. Canvas messages are preferred, but email is fine as well. Please include your full name, A-Number, and the course name in your message. I will attempt to respond to your messages in a timely manner, but I have responsibilities outside of the course that may prevent me from doing so, and I ask you to exercise patience after sending your message.

The instructor will hold regular office hours as listed in this syllabus as well as by request.

Course announcements will be made using Canvas. You are expected to check Canvas at least once a day and are responsible for any information in the announcements. "But I did not know" is not an acceptable excuse for being unaware of information in course announcements.

Getting started in the course

Read the course syllabus. Once that is done, your first assessment is a "Getting Started" online quiz located on Canvas that will cover course policy as discussed in the syllabus. This Quiz is due at 11:00 PM on the Friday of Week 1 of the term. The Getting Started quiz will be graded immediately upon completion and may be attempted an unlimited number of times. Correct answers will not be shown upon completion of the Getting Started Quiz, but you will be able to view your responses. If multiple attempts are made, the **latest** score will be accepted. **If you see no score in your Grades, no attempt was submitted.** The Getting Started Quiz score cannot be dropped.

USU welcomes students with disabilities. If you have, or suspect you may have, a physical, mental health, or learning disability that may require accommodations in this course, please contact the Disability Resource Center (DRC) as early in the semester as possible (University Inn #101, 435-797-2444, drc@usu.edu). All disability related accommodations must be approved by the DRC. Once approved, the DRC will coordinate with faculty to provide accommodations.

Lectures and Recitations

It is assumed that you read textbook sections, as outlined in the schedule at the end of this syllabus, prior to discussing them in Lecture. You are strongly encouraged to take notes while reading the textbook and then supplement those notes with Lecture. You are not expected to understand the material simply by reading the textbook, but reading the chapter will build a foundation that we can expand and refine through our discussions in Lecture. PDF copies of blank Lecture PowerPoint slides will be available on Canvas that can be printed ahead of each Lecture if you wish. Each Lecture will be recorded and available on Canvas for viewing at your pleasure.

You must be registered for a recitation section (CHEM 1210 sections 524-527). Recitations will involve guided, group problem sessions. Recitation attendance is required. Multiple choice quizzes, consisting of 5 questions worth 5 points in total, will be given at the conclusion of Recitations for all

weeks Recitations meet as listed in the schedule in this syllabus except Week 2. The quizzes will cover concepts covered in the previous week's lectures, which will be reviewed in Recitation. The lowest Recitation score will be dropped.

iClicker Questions

iClicker questions will be asked through the Lecture period and will be used as a way to assess class understanding of topics by providing immediate feedback to both the instructor and you. These questions must be answered individually, but consulting your notes and discussing with your classmates is allowed. It is your responsibility to register your iClicker either through the iClicker service on Canvas or at iclicker.com, and to remember to bring your iClicker, in working order, to class each day. iClicker questions will be utilized on Day 1, but student performance will not be recorded until the third Lecture period.

To encourage you to attend, prepare for, and be attentive during lectures, you may earn up to 10 points extra credit via iClicker questions. 5 of those points are allocated to participating in iClicker questions, and the remaining 5 points are allocated to answering iClicker questions correctly. The amount of extra credit awarded will be based on the percentage of iClicker questions answered by each student based on the total number of questions asked and the percentage of correct answers to iClicker questions based on the total number of questions asked.

Chem101

Chem101 is an online service that is being provided free of charge this semester. Follow the instructions in the document on Canvas for enrollment. Skip the instructions regarding payment.

Each chapter section will have a Chem101 homework assignment. These assignments are designed to provide additional practice to help you prepare for the quizzes and exams. The assignments will typically be due at 11:00 PM two days after the chapter section is completed in Lecture. This is the same time the Post-Chapter Quiz will be due. Each assignment will be worth 10 points. The lowest 2 homework assignment scores will be dropped at the end of the course.

Quizzes

An end-of-Chapter Quiz will be assigned for each chapter section covered in the course. The Quizzes will typically close at 11:00 PM two days after the chapter section is completed in Lecture. Check Canvas for specific due dates. Chapter Quizzes will be worth 20 points. You will have 50 minutes to complete the Chapter Quiz and you may use your textbook and notes, but you must work alone. You should treat Post-Chapter Quizzes as practice for the Exam in terms of both format and content and it is strongly recommended that you do not use external resources on your first Quiz attempt so as to more accurately gauge your understanding of the material. You may take each Post-Chapter Quiz twice to account for any technical difficulties you encounter, such as losing power or logging out accidentally. After successfully completing the Quiz, you may choose to retake the Quiz to try and maximize your score, but note that only the **last** attempt will be accepted. Therefore, if your second attempt at the Quiz has a lower score than the first attempt, the second attempt's score is still what will be counted as your score for the Quiz. The lowest two Post-Chapter Quiz scores will be dropped at the end of the course.

Examinations

There will be three 60-minute midterm Exams, worth 100 points each, held in the Testing Center that will be administered according to the following schedule:

First Exam: Friday, September 27 to Monday, September 30
Second Exam: Wednesday, October 23 to Friday, October 25
Third Exam: Wednesday, November 13 to Friday, November 15

These Examinations will consist of 25 questions worth 4 points each. Question formats may include, but are not limited to, multiple choice, multiple answer, matching, short written answer, and fill-in (dropdown and text).

Make-up Exams for missed Exams may be granted upon petitioning the instructor only in the following situations: 1) documented and acceptable excuses for illness when verified by a doctor's note; 2) a family emergency when verified by a note from your academic advisor; 3) a regularly scheduled university-sanctioned conflict, such as a sports competition the student is participating in, but only when the instructor is notified well in advance of the conflict and verified with a note from the person in charge of the activity containing the specific reasons for the absence. Absences due to reasons not considered by the university to be excused absences, such as weddings, are not eligible for make-up Exams.

The only materials permitted in the Testing Center will be writing utensils and calculators (scientific preferred, graphing only if the Testing Center clears the memory). The Testing Center will provide laptops and authorized auxiliary materials as well as scratch paper upon request. Reservations for the Testing Center are made through their website at <http://testing.usu.edu/>. Ensure you bring a form of ID with you in order to Check-in for your Testing Center appointment.

A 120-minute cumulative Final Examination will be held in the Testing Center on from Monday, December 9 to Wednesday, December 11.

Academic Integrity

All Utah State University academic integrity policies are strictly enforced. All students at Utah State University agree to be bound by the following Honor Pledge "I pledge, on my honor, to conduct myself with the foremost level of academic integrity." See the following for further information: <https://studentconduct.usu.edu/studentcode/article5>. Students found guilty of academic misconduct on any assignment will, **at minimum, be given a zero for the assignment and have the full value of that assignment deducted from their final course grade.** Actions up to and including a failing grade for the course are options available to the instructor.

Course Assessment

After the first Exam, the instructor will solicit feedback through optional midterm evaluations on Canvas. The purpose of these surveys will be to determine student opinions of the course up to that point and ask for suggestions on what could be done to improve the course for the rest of the semester and in subsequent semesters. The instructor will know who completed the survey, but will be unable to match survey responses to students. Each student who responds to the midterm evaluation will be granted a small quantity of extra credit points. At the end of the course, end-of-term IDEA evaluations administered through University will be sent to students via email. The

instructor will know who completed the survey, but will be unable to match survey responses to students. Each student who responds to the end-of-term evaluation will be granted a small quantity of extra credit points.

A Pre-test/Post-test approach will be used to measure comprehension and teaching of important concepts. The Pre-test will be administered online through Canvas. The Pre-test will be comprised of 20 questions with a duration of 60 minutes. The questions of the Pre-test will reappear in the Final Exam, in some form, to assess teaching and learning progress during the semester. If weaknesses are observed in specific subject areas, teaching methods will be reevaluated. An all-or-nothing 10-point reward will be given for completing the Pre-test. The Pre-test is due at 11:00 PM on the Friday of Week 1.

Grading

The total score for each type of assignment represent totals after appropriate lowest scores have been dropped.

Getting Started Quiz	20	Percentage of Points Earned	Grade
Pre-test	10	88 – 100	A-, A
Chapter Quizzes	200	77 – 87	B-, B, B+
Chem101 Homework	100	60 – 76	C-, C, C+
Recitation Quizzes	50	50 – 59	D, D+
First Exam	100	< 50	F
Second Exam	100		
Third Exam	100		
Final Exam	200		
<hr/> Total points	880		

Letter grades are assigned by taking the total numerical score, rounding to the nearest whole number, finding the percentage of total points earned, and then assigning a letter grade according to the table above. The grade thresholds may be lowered depending on course performance, but will never be increased. The administration of CHEM 1210, including the issuing of grades of Incomplete, will adhere to the outlines in the USU General Catalog.

Fall 2019 Schedule

Please look carefully at the following schedule for the correct order of Lectures. Note that this schedule is approximate and may adjust depending on course pace.

Red text denotes the days Exams will be scheduled. **Blue text** denotes holidays where Lecture will not be held. Quiz due dates may be adjusted as a result of course pace.

Week	Day	Date	Lecture	Topic	Chapter	Recitation	Assignment Due	
1	M	8/26	1	Course intro, Matter, Elements, Compounds	1	none		
	W	8/28	2	Measurements	1			
	F	8/30	3	Atomic Structure	2		GS Quiz/Pre-test/Chapter 1 Quiz	
2	M	9/2	Labor Day			all except Monday, no graded Quiz		
	W	9/4	4	Periodic Table	2			
	F	9/6	5	Nomenclature	2			
3	M	9/9	6	Balancing Equations	3	all	Chapter 2 Quiz	
	W	9/11	7	Atomic/Molecular Weights	3			
	F	9/13	8	Empirical Formulas	3			
4	M	9/16	9	Calculations with Chemical Eq.	3	all		
	W	9/18	10	Molarity, Electrolytes	4		Chapter 3 Quiz	
	F	9/20	11	Acids, Bases, Salts, and Ions	4			
5	M	9/23	12	Metals	4	all		
	W	9/25	13	catch up, prepare for exam 1			Chapter 4 Quiz	
	F	9/27	First Exam (Ch 1-4)					
6	M	9/30	14	Energy, First Law	5	all		
	W	10/2	15	Enthalpy, Hess' Law	5			
	F	10/4	16	Enthalpy of Formation	5			
7	M	10/7	17	Radiant Energy	6	all	Chapter 5 Quiz	
	W	10/9	18	Quantum Effects	6			
	F	10/11	19	Bohr Atom, Orbitals	6			
8	M	10/14	20	Many Electron Systems	6	none		
	W	10/16	21	Atomic Sizes, Atomic Energies	7		Chapter 6 Quiz	
	R	10/18	Fall Break					
9	M	10/21	22	catch up, prepare for Exam 2		all	Chapter 7 Quiz	
	W	10/23	Second Exam (Ch 5-7)					
	F	10/25	23	Lewis Structures	8			
10	M	10/28	24	Covalent Bonds	8	all		
	W	10/30	25	Resonance, Octet Violations	8			
	F	11/1	26	Bond Energies	8			
11	M	11/4	27	VSEPR Theory	9	all	Chapter 8 Quiz	
	W	11/6	28	Bond Polarity	9			
	F	11/8	29	Hybrid Orbitals	9			
12	M	11/11	30	catch up, prepare for Exam 3		all	Chapter 9 Quiz	
	W	11/13	Third Exam (Ch 8-9)					
	F	11/15	31	Gases	10			
13	M	11/18	32	Gases	10	all		
	W	11/20	33	Gases	10			
	F	11/22	34	Liquids and Solids	11/12		Chapter 10 Quiz	
14	M	11/25	35	Liquids and Solids	11/12	none		
	W	11/27	Thanksgiving Break					
	F	11/29	Thanksgiving Break					
15	M	12/2	36	Solution Properties	13	all	Chapter 11/12 Quiz	
	W	12/4	37	Solution Properties	13			
	F	12/6	38	catch up, Prepare for final exam			Chapter 13 Quiz	
16	M/T	12/9 – 12/13	Final Exam (cumulative)					

Chapter Learning Objectives

Chapt 1: Define matter and classify it from the level of mixtures and compounds to elements

Differentiate physical and chemical properties and changes and intensive and extensive properties.

List and define the base S.I. units of mass, length, time, temperature and amount of a substance, and manipulate the base units to give derived SI units

Use the principles of dimensional analysis and conversion factors to convert quantities expressed in one unit to another unit.

Express numbers in different units by using the prefix and exponential notation methods.

Explain the difference between precision and accuracy, and relate these terms to the concept and usage of significant figures in experimental measurements.

Chapt 2: Explain the atomic theory of matter, emphasizing the composition of the atom, and what defines the identity of a given element.

Explain the relative sizes, masses, and charges of the proton, neutron, and electron, and how they assemble to form an atom.

Define the term isotope, and be able to discern the subatomic composition of an atom given its atomic and mass numbers. Represent the atom using the element symbol with superscript and subscript denoting the composition.

Use the Periodic Table to rationalize similarities and differences of elements, including physical and chemical properties and reactivity. Predict common ion charges of group 1A, 2A, 3A, 6A, and 7A elements based on position in the periodic table.

Name and predict ions formed from the elements, and recognize and be able to name common polyatomic cations and anions.

Differentiate between ionic and molecular compounds, and empirical and molecular formulas

Given the chemical formula for an ionic compound or molecule, provide a proper unambiguous systematic name for the compound. Conversely, given the compound name, write the single chemical formula that matches the name.

Chapt 3: Given the reactants and products for a chemical equation, balance the equation using whole number coefficients.

Recognize the following common chemical reactions: combustion, decomposition, combination.

Given the atomic weights and relative abundances of naturally occurring isotopes, calculate the average atomic weight of an element.

Use average atomic weights from the Periodic Table to calculate formula weights and molecular weights for compounds.

Use the concepts of the mol, molar mass and Avogadro's number and conversion factors derived from their relationships to interconvert between mass, mols, and numbers of particles for atoms and molecules.

Explain the basis for the "mass defect" seen when an experimentally determined molar mass for an atom is compared to the sums of the masses of the subatomic particles in that atom.

Use the stoichiometric relationships between atoms in molecules, and the stoichiometric coefficients on reactants and products in chemical reactions, to interconvert between numbers of particles, mols, and masses within compounds and for chemical changes.

Given the molar mass of an unknown compound and its elemental composition in mass percent, determine the empirical and molecular formulas for the compound.

Given a chemical reaction and masses of reactants, determine the limiting reagent if the reaction goes to completion, and calculate the masses of products formed and excess reagent remaining at the conclusion of the reaction.

Chapt 4: Understand solution composition and the terms solvent and solute

Differentiate between weak and strong electrolytes and nonelectrolytes

Define and differentiate strong and weak acids and bases

Define "solubility" and "miscibility" and understand the factors that make a solute soluble in water

Define and write representative equations for aqueous reactions involving neutralization, precipitation, gas generation, and oxidation/reduction.

Define and write representative equations for molecular equations, complete ionic equations, net ionic equations.

Recognize spectator ions in aqueous reactions

Define solution concentration in units of molarity and use dimensional analysis to interconvert molarity, mass, mols, and volume.

Chapt 5: Define energy in terms of work and radiation (heat), and differentiate the following types of energy and the terms that relate to it: kinetic, potential, thermal, chemical energy; conservation of mass, system and surroundings, state function

Describe energies, energy changes and associated signs referenced relative to the system of interest
Define enthalpy and exothermic and endothermic reactions

Determine the enthalpy for a reaction given information from a standard table of enthalpies of formation or using specific heat and calorimetry data

Apply Hess' law to determine enthalpies of reaction

Chapt 6: Describe the properties of electromagnetic radiation, and use the appropriate equations that interrelate energy, frequency, wavelength, Planck's constant, and the speed of light

Explain the concept of "photons" and "quanta" and the dual nature of radiant energy

Explain the Bohr model of the hydrogen atom and use the Rydberg equation to determine the energies associated with electronic transitions

Explain the dual nature of matter (wave and particle).

Explain how the Heisenberg uncertainty principle and Schrodinger models relate to electronic structure

Describe electronic structure in terms of orbitals, with associated quantum numbers n , l , m_l , and m_s and how these quantum numbers relate to the energies, shapes, orientations, and spins of electrons in atoms

Use the above principles of quantum chemistry together with the Pauli exclusion principle and Hund's rule to predict the electronic configurations of multielectron atoms

Chapt 7: Predict periodic properties, including relative sizes of atoms, ionization energies, and electron affinities using the principles outlined in class

Chapt 8: Understand and describe chemical bonding at the level presented in class, with particular emphasis on understanding and applying the following terms/concepts: Lewis symbols and atoms, Ionic bonding, Lattice energy, isoelectronic series, covalent bonding, electronegativity and bond polarity, Lewis structures, formal charges, resonance, octet violations, bond strengths, oxidation numbers

Chapt 9: Apply valence shell electron pair repulsion theory to properly-drawn Lewis structures to predict bond angles and geometries about atoms in molecules

Use valence bond theory to describe covalent bonding in terms of orbital overlaps and hybridizations

Chapt 10: Describe the properties of a gas in terms of the variables P , V , n , and T

Use the Ideal gas law to interconvert between P , V , n , and T for a gas

Understand and explain Kinetic-molecular theory

Explain the factors that lead to non-ideal behavior for a gas

Chapt 11: Understand and identify the intermolecular forces important in different solids and liquids Describe the processes by which states of matter are changed

Define vapor pressure and boiling point

Interpret heating curves and phase diagrams for a compound

Chapt 13: Understand the solution process in terms of thermodynamics

Explain the factors that affect solubility of a solute

Understand and explain the different colligative properties and use the proper mathematical equations to quantitatively describe these effects