

Instructor Dr. Michael Swanson
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Class Lectures: TR 8:00 – 9:50; Olin 105
Office Hours: TR 7:30 – 8:00a & 9:50 – 10:30 (by appointment)

There are only 98 naturally occurring elements in the Universe yet they are responsible for the seemingly infinite diversity we see around us, from the largest super nova to the smallest virus. The Earth itself is comprised primarily of 7 elements (oxygen, silicon, magnesium, sulfur, nickel, calcium and aluminum) which account for approximately 99% of its mass. Part of the remaining 1% of the Earth's mass comes from carbon, hydrogen, nitrogen and phosphorus, the elements of life. All elements contain the same three subatomic particles; the proton, neutron and the electron. Protons and neutrons make up the nucleus of atoms and are responsible for 99.9% of an atom's mass but only about 1/100,000th of the volume. MATTER IS COMPRISED PRIMARILY OF EMPTY SPACE! How do three subatomic particles come together to form 98 unique elements? How do these elements interact to form molecules? How do molecules interact with other molecules and undergo change? What are the driving forces behind these interactions? These are just a few questions we hope to answer in this course. Welcome to General Chemistry!

COURSE OBJECTIVES

After General Chemistry, you should be able to do the following:

- Relate atomic spectra to electronic transitions
- Predict trends in atomic properties
- Predict molecular shapes and polarity
- Apply molecular bonding theories
- Complete stoichiometry calculations
- Balance complex chemical equations
- Relate pH to molar concentrations of acids and bases
- Calculate heats of reaction for chemical reactions
- Determine if a reaction is spontaneous

REQUIRED COURSE ITEMS

Textbook: 1-Semester Access (180 days) to Connect Plus Chemistry with LearnSmart and eBook - *Chemistry: The Molecular Nature of Matter and Change*, 7th Edition, Silberberg, McGraw-Hill Publishers - \$85 (ISBN-13 9781259224713). <http://shop.mheducation.com/highered/product.1259224716.html>

****I recommend you purchase directly from McGraw-Hill. DU Bookstore only has 2-semester at a ~30% markup.**

No paper text is required but you can buy a used copy of the 5th or 6th editions of the Silberberg text if you wish (The Connect Plus account is still required). Used copies cost about \$15 – 50 on Amazon.

Online homework: You will be required to participate in LearnSmart modules and submit problem sets via an online homework system called Connect. Instructions for enrolling in Connect are given on Canvas.

Calculator: An inexpensive calculator that has the capabilities for square roots, logarithms, and (exponential) scientific notation operations.

READINGS AND LEARN SMART ASSIGNMENTS. Assigned reading should be completed prior to class. The adaptive learning software LearnSmart will be used to reinforce the concepts from the book and online lectures. *There will be a LearnSmart assignment due before each class* (links on Canvas and Connect). The length and content of each assignment will vary between students depending on their understanding of the material. The more closely you read the material and view the recorded lectures, the less time you are likely to spend on these assignments. LearnSmart assignments (6.25 points each) will not be graded based on right/wrong answers but on completion. Students are strongly encouraged to spend extra time using the features in the LearnSmart interface to study.

CLASS MEETINGS. Important concepts from readings will be highlighted during lectures. Periodically throughout lecture, questions will be posed and you will be given time to work through and discuss them with your fellow classmates. Step-by-step solutions will then be presented to the class. *The Tuesday lectures before midterm exams will be "flipped"*. This means that a recorded lecture will be posted online. You will be required to watch these recorded lectures before the scheduled lecture time. Class time will be spent answering questions about the lecture, working through the problem set for those weeks and reviewing for the upcoming exam.

PROBLEM SETS. Practicing problems is very helpful in the mastery of chemical concepts. Thus, problem sets will be assigned throughout the quarter using the on-line Connect system. These homework problems will be worth a total of 100 points and will be *due weekly* (by 10 pm Saturday nights, and 10 pm Tuesday nights during the week of an exam). *Late problem sets will be deducted 20% per day.*

EXAMS. There will be three (3) one-hour exams given during the quarter and a two-hour, cumulative final exam. Dates for these exams are posted below on the lecture schedule. **NO MAKE-UP EXAMS WILL BE ACCEPTED.** There is one exception to this policy. If you will be out of town for a University sanctioned function (e.g., athletic team or music group), you are responsible for making arrangements with Dr. Swanson at least one week in advance to complete the exam prior to the scheduled date. If you miss an exam, then your final exam will be counted twice to replace the missed exam.

If your grade on your final exam is higher than one of your hour exams, your final exam will be counted twice to replace your lowest hour exam grade.

GRADES. Final grades will be determined according to performance on exams, problem sets and completion of LearnSmart modules. There will be a maximum of 600 points for the course:

<u>Component</u>	<u>Points</u>
Hour Exams (100 points each)	300
Final Exam	100
LearnSmart Modules (6.25 points each)	100
Homework (10 points each)	100
Total Points	600

SUCCEEDING IN CHEMISTRY. Here are few helpful hints on how to succeed in this class:

Do your best on the exams!

How?

1. Read the material in the text book BEFORE class. Don't get behind.
2. Follow check list of assignments (Canvas). Complete every assignment possible.
3. Attend class regularly. Take notes on content learned in lecture (Problems worked).
4. Be ready to ask questions... and ask them! Get help from course instructor!
5. Study with other students in the class.

SEEKING HELP. If you need help in the class, first be sure that you are following steps 1-3 listed above. If you still require assistance there are several places for you to go:

- ***The instructor:*** office hours are available after each class for one-on-one consultation. Contact the instructor via email or phone.
- ***The Science and Engineering Learning center:*** TAs are available throughout the week to answer questions on both lecture and lab material (See Below).
- ***Peers (Study Groups):*** Take opportunities to help those around you and to ask them for help. You can learn a great deal from your fellow classmates.
- ***Tutors:*** The Chemistry Department office has a list of graduate student tutors.

The Science and Engineering Learning center: Science and Engineering Learning Center: Need extra help? The Science and Engineering Learning Center is a collaborative space staffed by undergraduate and graduate TAs trained to assist students with first and second year chemistry, physics, and engineering lecture and laboratory courses. Our goal is to help students grow as problem solvers by assisting with homework sets, lab reports, and preparing for exams. The Science and Engineering Learning Center is not a one-on-one tutoring center, but is rather a support system where students can get guidance from TAs as well as their peers. This center is open to all DU students. All services are free. Located in the north-west corner of the first floor of the Anderson Academic Commons (west of the writing center).

LECTURE AND TESTING ACCOMODATIONS. Every effort will be made, in complete confidence, to accommodate students diagnosed with a learning disability. Any student requiring these accommodations should inform Dr. Swanson the first week of class. For further information, please see DU's Disability Services' website at <http://www.du.edu/disability/dsp/index.html>.

ACADEMIC DISHONESTY. Collaborative learning and teamwork are very important parts of science but cheating of any kind will not be tolerated. Each student is required to provide their own work on homework and exams. ***Copying an exam or homework (as well as any behavior that could be interpreted as copying) will result in no credit being given on the assignment or exam.*** Repeated offences will result in failure of the course and possible expulsion from the University. Please refer to the University's honor code: <http://www.du.edu/ccs/honorcode.html>.

LECTURE SCHEDULE (problem set due dates in red, flipped lecture dates in blue)

DATE	TOPIC	READING	HOMEWORK
WEEK 1 - QUANTUM-MECHANICAL MODEL OF THE ATOM			
Sep 15	Introduction/Review Nature of Light	Chpt. 7.1 - 7.2	
17	Electrons as Waves and the Quantum-Mechanical Atom	Chpt. 7.3 - 7.4, 8.1	
19			Problem Set 1
WEEK 2 - CHEMICAL PERIODICITY AND BONDING			
22	Periodic Properties	Chpt. 8.2 – 8.3	
24	Chemical Reactivity and Ionic Bonds	Chpt. 8.4, 9.1 – 9.2	
26			Problem Set 2
WEEK 3 - COVALENT BONDING AND ELECTRONEGATIVITY			
29	Covalent Bonds and Polarity (Flipped Lecture)	Chpt. 9.3, 9.5	
29*			Problem Set 3
Oct 1	HOUR EXAM I (Covers Sep. 15 - 29)		
WEEK 4 - LEWIS STRUCTURES AND MOLECULAR SHAPE			
6	Lewis Structures and VSEPR	Chpt. 10.1 - 10.2	
8	Polarity and Valence Bond Theory	Chpt. 10.3, 11.1	
10			Problem Set 4
WEEK 5 - COVALENT BONDING THEORIES / CHEMICAL REACTIONS			
13	Orbital Overlap and M.O. Theory	Chpt. 11.2 - 11.3	
15	Aqueous Solutions / PPT Reactions	Chpt. 4.1 - 4.3	
17			Problem Set 5
WEEK 6 - ACID-BASE CHEMISTRY			
20	Acid-Base Chemistry, pH, pKa (Flipped Lecture)	Chpt. 4.4, 18.1 - 18.3	
20*			Problem Set 6
22	HOUR EXAM II (Covers Oct 6 – Oct 20)		

WEEK 7 – 1ST LAW AND ENTHALPY

27	Enthalpy and Calorimetry	Chpt. 6.1 - 6.3
29	Hess's Law and Heats of Reaction	Chpt. 6.4 – 6.6
31		

Problem Set 7

WEEK 8 – 2ND LAW AND ENTROPY

Nov 3	2 nd Law of Thermodynamics	Chpt. 20.1
5	Calculating Entropy	Chpt. 20.2
7		

Problem Set 8

WEEK 9 – 3RD LAW AND FREE ENERGY

Nov 10	Free Energy (Flipped Lecture)	Chpt. 20.3 (Chpt 12, only what is in lecture)
10*		
12	HOURLY EXAM III (Covers Oct 27 - Nov 10)	

Problem Set 9

WEEK 10 – ELECTROCHEMISTRY

17	Redox Reactions	Chpt. 4.5, 4.6
19	Electrochemical Cells	Chpt. 21.1-21.3
19		
Nov 21	FINAL EXAM: 8AM to 9:50AM (Cumulative)	

Problem Set 10