General Chemistry with Lab

CHM-201-04, Spring 2022

Professor Jennifer Mortensen

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Office Hours on Zoom:
Monday 2-3; Wednesday after class & by appointment

Course Times:
Lab: Tuesday 11:30 – 2:00
D Building, D314
Lecture: Wednesday 10:00 – 12:45
via Zoom

Lab will meet on Zoom until February 7th. In-person laboratory meetings will begin on February 8th.

Zoom link: https://tufts.zoom.us/j/99446130349?pwd=NCtKVTlXQW80MmgvTlJJYkpyUjQxQT09

Course Description:

This course is a rigorous introductory course as part of a two-semester sequence that studies chemical principles. Topics include atomic structure, reaction types and equations, stoichiometry, gas laws, thermochemistry, and bonding theory. Note: This course is intended for students planning to major or transfer as science or engineering majors. Pre-allied health students or students requiring a one semester overview of chemistry should enroll in Principles of Inorganic Chemistry and Lab (CHM-120).

Prerequisites: MAT-197 with a minimum grade of C-
ENG-111 with a minimum grade of C- (May be at the same time as this course.)

Textbook and Supplies

Required Supplies:

- *Chemistry, the Science in Context*, 6th ed.; Thomas R. Gilbert, Rein V. Kirss, Natalie Foster, Stacey Lowery Bretz, and Geoffrey Davies; W. W. Norton and Company 2018
  - You **do not** need to purchase online access to accompany the text
- Scientific Calculator capable of displaying scientific notation and performing logarithms and exponents
- Reliable computer and reasonably fast internet.

Optional Supplies:

- Laboratory safety goggles, ANSI approved (available in the College Bookstore)
- Textbook solutions manual and study guide, available in the bookstore and online.

Notes on Supplies:

- If you have difficulty with internet or obtaining any supplies for this course, please contact me as soon as possible so we can work together to find a solution
- Safety goggles are available for use during lab. You are welcome to purchase your own.
- Smartphones and tablets may not give you adequate access to all aspects of the online course material.
- Chromebooks may be available for loan through the BHCC campus. Please contact Single Stop for more information at https://www.bhcc.edu/singlestop/

What will this class be like?

This class is designed around two ideas: **You learn better by *actively doing* chemistry** and **Every student learns at a different speed.** The first idea is reflected in the course structure which focuses on doing practice problems and discussing chemistry topics. The second idea is the core of the standards-based grading scheme we will use.

Schedule and flow of course activities:
Your work in this class will involve you **before, during, and after** each meeting. This format allows you to learn material on your own time, break lecture into smaller segments, and assess your understanding on your own before attending class. You should expect to spend 3 hours a week watching asynchronous course material and completing the homework.

- **BEFORE each class**: Videos on this week's course material will be posted on Moodle. Watch the videos, read the textbook, and complete the corresponding homework questions. The homework based on these videos will be due at 11:59pm the night before class. Estimated time: 2 hours
- **DURING each class**: Class meetings will typically start with 20 minutes answering questions on the homework and reviewing the topics in the videos. Then we will spend about 20 minutes going over new material. After a short break, we'll spend 20-30 minutes working on harder problems together. Most weeks class will end by 11:30. Estimated time: 1.5 hours
- **AFTER each class:** Attend office hours after class to get extra help on any topics you don't fully understand. Optional problems will be posted on Moodle to provide extra practice. You can also begin the videos for the next week as soon as class is over. Estimated time: 1 hour.

What assignments will be given?

Homework (due every week): Each set of videos will have an associated homework to provide practice applying the new material. You will receive full credit if you *attempt* every problem. *You don't need to get the problems correct to receive credit.* Due Tuesdays at 11:59pm.

Labs (9 total, groups of 2): Labs will require pre-lab and post-lab work as described on page 5.

Learning Target Quizzes: Once a month, we will use the in-person laboratory time to complete a learning checkpoint. During this time, you will take a short quiz for each learning target of the most recent units. Each quiz will contain 3 to 5 questions that require application of the learning target. The tentative schedule is below, and the full list of Learning Targets is on page 7.

Learning Target retakes: Each week you can retake up to 3 L.T. quizzes. You can retake any remaining L.T. quizzes during the final exam period. Details on scheduling will be provided later. **You will be able to retake every quiz multiple times until you demonstrate mastery of the learning target.**

Date	Units	Learning Targets
Feb 22	Units 1 and 2	1.1 to 2.3
March 22	Units 3	3.1 to 3.4
April 12	Units 4 and 5	4.1 to 5.4
May 3	Units 6 and 7	6.1 to 7.1*

*LT 7.2 - 7.4 will be assessed via worksheets during Lab 10

To help track your progress towards meeting the Learning Targets, a weekly progress report will be handed out during lab. This progress report will show your progress towards each L.T. and your current homework and lab grades.

How Learning Targets are assessed

Learning happens over time, as we revisit ideas and reflect on them. In this class, your final grade will reflect how well you *eventually understand* each topic. You can make mistakes without penalty, as long as you *eventually* demonstrate mastery of the topic.

Each Learning Target will be assessed with a short 2 to 5 question quiz. **Each quiz will be graded based on if it meets standards of acceptable work. There will be no partial credit**. If your work doesn't meet the standard, you'll be given feedback on it and a chance to redo it. This grading system allows for more flexibility and an emphasis on learning the necessary topics. By eventually showing that you have mastered the learning targets for this course, you can earn a grade that represents your understanding.

There are 26 Learning Targets in the course, which form an outline of all the important topics in Chapters 1-9 of the textbook. 11 of these are designated as **Core** targets due to their central nature in chemistry, and the other 15 are designated as **Supplemental**. An important goal for you in the course is to **demonstrate proficiency in all the Core targets and as many of the Supplemental targets as you can**.

Assessment Scheme

Your grade will be determined based on your achievements in each category, listed below. The nature of this course and ability to retake quizzes means that each of you can achieve a high grade in this class. If you have question on your grade, or you feel you are falling behind, please reach out sooner rather than later so we can get you back on track.

- **Homework (Out of 100pts)**: Weekly homework will be posted on Moodle. Homework will be graded complete/not complete. Attempting the homework and correcting your mistakes will help you understand the course material.
- **Lab (out of 27pts)**: Each lab is worth 3 points (pre-lab, lab material and post-lab). We will have 9 labs total. If lab cannot be conducted in-person, equivalent at-home material will be assigned.
- **Core Learning Targets: (11 total)** These learning targets are the foundation of chemistry and must be mastered before continuing to Chem 202.
- **Supplemental Learning Targets (15 total)**: These learning targets expand on the material covered in the core learning targets. Understanding these topics will provide you with a better understanding of chemistry and foundation for future courses.

Grades will be assigned according to the table below. To earn a given grade you must fulfill **ALL** the criteria for that grade.

Grade	Core L.T.	Suppl L.T.	HW	Lab
A	11	14	90	24 (88%)
A-	11	13	85	24 (88%)
B+	11	12	85	21 (77%)
B	10	11	80	21 (77%)
B-	10	10	75	21 (77%)
C+	10	9	75	18 (66%)
C	10	8	70	18 (66%)
C-	10	7	65	18 (66%)
D	9	5	60	18 (66%)

Policies and Responsibilities:

Student responsibilities:

1. **Prepare for class!** To avoid 3 hours of lecture on Wednesdays, class material will be presented in videos on Moodle. Watch these videos before class and complete the practice problems and homework. We can then use class time to discuss the hardest topics and work on problems together.
2. **Participate in class!** Class will include interactive activities and practice problems; come prepared to contribute. Respect your instructors and classmates by being on time, listening, and contributing.
3. **Be safe!** Follow all lab safety protocols and wear a mask at all times when in the lab.
4. **Ask for help early.** If you feel you are falling behind or confused about course material, set up a meeting as soon as possible. I can't help you if I don't know you need help. **Please note: There is no incentive to commit academic dishonesty in this class since you can retake every quiz.** If you feel that cheating is the only way to improve your grade: DON'T DO IT! Instead, get some help and take comfort in the fact that you can just submit your best effort, get feedback, and try again later.
5. If you need course adaptations or accommodations, or if you have medical information to share with me, please let me or the Office of Disability Services know as soon as possible.

Instructor responsibilities:

1. Begin class on time.
2. Make learning goals and objectives clear.
3. Engage students with material through in-class activities and practice problems.
4. Keep Zoom lecture meetings under 1.5 hours.
5. Give students a full week to watch asynchronous video lectures.
6. Promptly respond to emails 2-3 times a day. Emails will not be answered after 5pm or on weekends.
7. Grade assignments quickly, fairly, and accurately.
8. In the case that changes in the syllabus or class schedule become necessary, clearly communicate changes to the entire class both verbally and in writing.

Laboratory Assignments:

Laboratory is an important part of every Chemistry course. In the lab, you will learn how to use equipment, record results, and draw conclusions. You will receive 3 grades during each lab (graded as Completed and Not Completed): the pre-lab assignment, the lab itself, and the post-lab assignment. An example for each assignment will be handed out before the first week of lab.

Pre-lab assignment (due at the start of lab)

To be prepared for lab, you should thoroughly read the lab hand out and instructions and complete the pre-lab assignment. If you have not completed the pre-lab assignment, you will receive a grade of Not Completed and be required to complete it before you can start that week's experiments.

Assignment details:

- In a few sentences, describe the overall goal of the experiment.
- List the steps you will take to complete the experiment.
- Explain how these steps helps you accomplish the overall goal of the experiment.
- Complete any pre-lab questions.

Lab Assignment: To receive a Complete on the lab you must:

- Fully and safely participate in all lab activities
- Take clear and detailed notes on all experiments

Post-lab assignment (due at 11:30am on Tuesdays, 1 week after lab)

- Complete any lab questions
- Write a 1-2 paragraph summary of the lab results

You will receive 1 point for each Complete (3 points total per lab). Your lab grade for the course will be out of 27 points.

If you miss a lab due to illness or other reasonable excuse, you will be given an opportunity to complete the lab assignment by watching a video of the material or attending a different lab section (if possible). If you miss the lab for another reason, you may not be able to make up the points

As always, contact me as soon as possible if you need to miss lab so we can discuss your options for completing the material.

Lab Learning Objectives

1. I can record raw data and present experimental results and observations in a scientifically accepted format and using the scientific method.
2. I can independently draw conclusions about the experimental system, communicate results clearly and neatly and submit a written report of the laboratory results.
3. I can calculate an enthalpy change from calorimeter data.
4. I can calculate the concentration of a solution using titration data.

Covid-19 Policies

As you are aware, we will be having class this semester while trying to navigate a global pandemic that seems to change every day. While we can't predict even the near future, the following are general guidelines and plans for how we can work productively together in the course.

Taking care of yourself
Above all else, **take care of your own physical and mental health**. Make sure you are getting sufficient rest, staying connected to friends and family, and giving yourself time and space to do things you enjoy outside of college. This website lists several good tips for maintaining good self-care in our situation.

Before coming to campus, perform a self-evaluation each time and if you feel even the slightest bit of sickness or Covid-19 symptoms, **stay home and email me**. You should be on campus only if you feel *healthy*. Labs and quizzes can be made up once you are feeling better.

When you are present on campus, please observe the following:

Always wear a mask. A surgical mask, KN95, or N95 mask must be worn in the lab and classroom. Surgical masks are available at the main entrances to campus and N95 masks will be available in lab. Due to recent studies on the effectiveness of cloth masks in preventing the spread of Omicron, a cloth mask will not be allowed. If you are not able to wear a mask due to a medical condition, please talk to me before coming to class.

Students who remove their mask during class, wear it incorrectly, or refuse to wear a mask will be reminded of this policy once, and then asked to leave if non-compliance continues.

Practice appropriate personal hygiene. Wash your hands regularly or use hand sanitizer. If you must cough or sneeze, do so facing away from other people and use the inside of your elbow to cover your mouth, even if you have a mask on.

If plans change

The plan for this semester is to begin in-person labs and quizzes on 2/8. Depending on covid levels, this may change. The details for how we respond to events of the next semester depend on the situation, but please rest assured that plans are prepared for all likely scenarios including if the university goes fully online or if I cannot be present due to self-quarantine or infection.

Please note: I (Prof. Mortensen) reserve the right to make changes to the course at any time, including changing the modality of the course (e.g. to fully online) if I believe the situation warrants and independently of global actions BHCC does or does not take. I will always strive to do so with an appropriate level of input from you, but decisions about the course are vested in me.
Remember to check your email and Moodle announcements to stay notified of all course information.

Acknowledgements: Several sections of this syllabus are adapted from the work of Dr. Robert Talbert at Grand Valley state University (https://github.com/RobertTalbert/calculus).

Learning Targets

Unit 1: What is matter?

1.1. I can categorize matter into elements, compounds, and mixtures. (Ch. 1)
1.2. I can distinguish between physical and chemical processes and properties (Ch. 1)
1.3. **[CORE]** I can describe the structure of atoms and ions, including the 3 fundamental particles that make up atoms. (Ch. 2)
1.4. **[CORE]** I can predict the electronic configuration of atoms and ions from their position in the periodic table. (Ch. 2)

Unit 2: How do chemists report chemistry ideas?

2.1. **[CORE]** I can convert between different units using dimensional analysis (Ch. 1)
2.2. I can evaluate the precision and accuracy of experimental results and express uncertain values with the correct number of significant figures (Ch. 1)
2.3. **[CORE]** I can convert between grams, moles, and numbers of atoms or molecules. (Ch. 3)

Unit 3: How do chemicals interact with each other?

3.1. **[CORE]** I can solve stoichiometry problems using chemical equations and molar masses. (Ch. 3)
3.2. I can identify limiting reagents and predict the theoretical yield of a chemical reaction. (Ch. 3)
3.3. [**CORE]** I can draw the Lewis structure of compounds.
3.4. **[CORE]** I can label oxidation states and balance redox reactions (Ch. 4)

Unit 4: How do molecules interact in solutions?

4.1. **[CORE]** I can calculate the mass of solute or volume of a stock solution needed to make a specific amount of solution with a specific molarity (Ch. 4).
4.2. I can predict the products of precipitation reactions and write a balanced chemical equation for them. (Ch. 4)
4.3. I can solve stoichiometry problems involving solutions, including titration problems. (Ch. 4)

Unit 5: How do molecules behave in gases?

5.1. **[CORE]** I can solve gas law equations and calculate quantities associated with matter in the gas phase. (Ch. 5)
5.2. I can use the ideal gas law to calculate the pressure, volume, temperature, or number of moles in a sample of gas. (Ch. 5.)
5.3. I can use the ideal gas law to solve stoichiometry problems involving gas and non-gas phase reactants and products. (Ch. 5)
5.4. I can use kinetic molecular theory to explain the physical properties of gases including the ideal gas law and diffusion and the molecular origin of nonideal behavior in gases. (Ch. 5)

Unit 6: What causes particles to react with each other?

6.1. **[CORE]** I can differentiate between a system and its surroundings and identify familiar endothermic and exothermic processes. (Ch. 6)
6.2. I can write appropriate thermochemical equations and calculate enthalpy changes using standard tables and Hess' Law of summation. (Ch. 6)
6.3. I can apply my understanding of inner- and outer-shell electrons to explain ionization energy and electron affinity trends of main group elements. (Ch. 7)

6.4. I can describe electronegativity and how it impacts chemical bonding patterns including ionic vs. covalent bonding, as well as polar vs. nonpolar bonds. (Ch. 8)

Unit 7: How do we know the physical shape of a molecule?

7.1. **[CORE]** I can determine the geometry and polarity of molecules using Lewis structures and the periodic table. (Ch. 8 and 9)
7.2. I can use atomic orbital hybridization and valance bond theory to explain orbital overlap, bond angles and molecular shape (Ch. 9)
7.3. I can draw molecular orbital diagrams of diatomic molecules and use MO theory to predict bond order and explain magnetic properties. (Ch. 9)
7.4. I can predict the hybridization of atoms (valence bond model) in structures and chemical formulas. (Ch. 9)