**General Chemistry with Lab**

#### **CHM-201, Spring 2022**

**Professor Jennifer Mortensen**

**Email:**

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**Office Hours:**

Monday 10:00am; Wednesday 11:30am & by appointment

**Course Times:**

Lab: Tuesday 11:30 – 2:00

Lecture: Wednesday 10:00 – around 11:30

**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.)

This course will meet remotely for all class meetings until February 7th. In-person laboratory meetings will begin on Tuesday, February 8th. Lecture will remain online.

**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).

**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
* Scientific Calculator capable of displaying scientific notation and performing logarithms and exponents
* Reliable computer and 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.
* You do not need to purchase online access to accompany the text

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 bring 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, breaking learning up into smaller segments, and assess your understanding on your own before attending class. The goal of each class period is to gain a solid understanding of one or more of the class Learning Targets.

* **BEFORE** **each class**: Videos covering this week’s learning targets will be posted on Moodle. Watch these videos and complete the corresponding homework questions. The online homework based on these videos will be due at midnight the night before class.
* **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. Class will typically end by 11:30.
* **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.

**Big picture Learning Targets:**

1. I can solve problems requiring unit conversions and relating number of particles to mass.
2. I can distinguish between physical and chemical transformations.
3. I can describe chemical reactions using balanced chemical equations.
4. I can predict the physical behavior of gases.
5. I can explain energy changes in chemical reactions conceptually and numerically.
6. I can predict bonding and molecular shapes for chemical compounds.
7. I can apply the scientific method to chemical problems.
8. I can successfully execute the techniques learned in the laboratory

**What assignments will be given?**

**Homework (due every week)**: Each set of videos will have an associated online 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 completely correct to receive credit.* Due Tuesdays at midnight.

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

**Learning Target Quizzes**: Each Learning Target will be assessed with a 2-5 question quiz. Instead of giving you a quiz every week, we will use 4 laboratory times to have in-person assessments where you will complete 5-7 L.T. quizzes. These are your opportunity to demonstrate mastery of the learning targets.

**Learning Target retakes:** Each week you can retake up to 3 L.T. quizzes. Details on scheduling will be provided at a later time. You can retake any remaining L.T. quizzes during the final exam period.

**Policies and Responsibilities:**

*Student responsibilities:*

1. **Prepare for class!** To avoid 3 hours of lecture on Wednesdays, most of the class material will be presented in videos on Moodle. Watch these videos before class and complete the practice problems and homework. We will 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 need to complete academic dishonesty in this class since you can revise and resubmit your quizzes.** If you feel that cheating is the only 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 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. End class around 11:30.
5. Give students a full week to watch videos.
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.

**How Learning Target 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 2-5 question quiz. Each quiz will be graded based on **whether or not it meets standards of acceptable work**. If your work doesn’t meet the standard, you’ll be given feedback on it and a chance to redo it. Quizzes will not be “one and done”; your grade will be based on what you *eventually* learn. This grading system allows for more flexibility and an emphasis on learning the necessary topics. If you can eventually show that you have mastered the learning targets for this course, you can earn the grade that represents your understanding of the material.

There are 26 Learning Targets in the course, which form an outline of all the important topics in Chapter 1-9 of the textbook. Eleven (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 are 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. + and – will be assigned if you complete some, but not all, requirements for a letter grade. (Ex: A student who achieves 11 Core L.T, 14 Supplemental L.T, 85% on HW and 22pts in lab will receive an A– )

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Letter grade** | **Core L.T** | **Supplemental L.T.** | **HW** | **Lab (out of 27)** |
| A | 11 | 14 | 90 | 24 |
| B | 10 | 11 | 80 | 21 |
| C | 10 | 8 | 70 | 18 |
| D | 9 | 5 | 60 | 18 |

**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

**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 and your partner can start the lab.

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 each step 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 complete notes on all experiments

**Post-lab assignment** (due 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 will 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](https://www.mayoclinichealthsystem.org/hometown-health/speaking-of-health/self-care-tips-during-the-covid-19-pandemic) for maintaining good self-care in our situation.

Before coming to campus for lab or in-person quizzes, 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:

**Wear a mask at all times.** A surgical mask, KN95 or N95 mask must be worn in the 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**

We will begin the semester with in-person labs and quizzes. 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 daily 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. I can categorize matter into elements, compounds, and mixtures. (Ch. 1)
2. I can distinguish between physical and chemical processes and properties (Ch. 1)
3. **[CORE]** I can describe the structure of atoms and ions, including the 3 fundamental particles that make up atoms. (Ch. 2)
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 we use mathematics to report chemistry ideas?**

1. **[CORE]** I can convert between different units using dimensional analysis (Ch. 1)
2. I can evaluate the precision and accuracy of experimental results and express uncertain values with the correct number of significant figures (Ch. 1)
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?**

1. **[CORE]** I can solve stoichiometry problems using chemical equations and molar masses. (Ch. 3)
2. I can identify limiting reagents and predict the theoretical yield of a chemical reaction. (Ch. 3)
3. I can predict the products of precipitation reactions and write a balanced chemical equation for them. (Ch. 4)
4. **[CORE]** I can label oxidation states and balance redox reactions (Ch. 4)

**Unit 4: How do molecules interact in solutions and in gasses?**

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).
2. I can solve stoichiometry problems involving solutions, including titration problems. (Ch. 4)
3. **[CORE]** I can solve gas law equations and calculate quantities associated with matter in the gas phase. (Ch. 5)
4. I can use the ideal gas law to solve stoichiometry problems involving gas and non-gas phase reactants and products. (Ch. 5)
5. I can use kinetic molecular theory to explain the physical properties of gases including the ideal gas law and diffusion. (Ch. 5)
6. I can explain the molecular origin of nonideal behavior in gases (Ch. 5)

**Unit 5: What causes particles to react with each other?**

1. **[CORE]** I can differentiate between a system and its surroundings and identify familiar endothermic and exothermic processes. (Ch. 6)
2. I can write appropriate thermochemical equations and calculate enthalpy changes using standard tables and Hess' Law of summation. (Ch. 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)
4. **[CORE]** I can differentiate between ionic and covalent bonding and be able to describe each of these types of bonding for representative elements using the octet rule. (Ch. 8)
5. 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 6: How do we know the physical shape of a molecule?**

1. **[CORE]** I can draw Lewis structures of covalent compounds and determine the geometry and polarity of the molecule. (Ch. 8 and 9)
2. I can use atomic orbital hybridization and valance bond theory to explain orbital overlap, bond angles and molecular shape (Ch. 9)
3. I can draw molecular orbital diagrams of diatomic molecules and use MO theory to predict bond order and explain magnetic properties. (Ch. 9)
4. I can predict the hybridization of atoms (valence bond model) in structures and chemical formulas. (Ch. 9)