

General Chemistry I

Chem 105, 5 credits, Spring 2025



Syllabus (noun): summary outline of a course of study.

Course Description (from the Bulletin): This is the first semester of the 1-year Chemistry 105/106 course sequence, which is specifically designed to meet the needs of science majors and preprofessional students. Topics covered include: atomic theory, atomic and electronic structure, chemical bonding, mole concept, stoichiometry, states of matter, formulas and equations, solutions and colloids.

Prerequisites: Credit for or concurrent enrollment in Math 104, completion of, or placement in any higher math course.

Class meetings (weekly):

- 3 hr lecture (T Th 9:40-11:10 am, HS 109);
- 1 hr discussion ([schedule on page 10](#));
- 2 hr 10 min lab ([schedule on page 11](#)); 5 credits total.

Contact information for Lecture Instructor/Course Coordinator:

Dr. Yijun Tang, Halsey 442, (920)424-7097, tangy@uwosh.edu

Contact information for additional Discussion and Lab instructors:

A01L A04D, A05D	Dr. Kevin Crawford	Halsey 410	(920)424-7433	crawfork@uwosh.edu
A02L	Dr. Yijun Tang	Halsey 442	(920)424-7097	tangy@uwosh.edu
A03L	Dr. Jennifer Mihalick	Halsey 439	(920)424-7095	mihalick@uwosh.edu
A04L	Dr. Jonathan Gutow	Halsey 412	(920)424-1326	gutow@uwosh.edu
A05L A01D, A02D, A03D	Dr. Michael Foley	Halsey 440	(920)424-1314	foleym@uwosh.edu

Drop-in question times (office hours): Any of the instructors in this course are happy to meet with you to answer questions related to the course, discuss study strategies, academics, your goals or life in general. All have regularly scheduled 'drop-in' office hours that will be posted in the course Canvas site. If you cannot make scheduled office hours, you can arrange an appointment by contacting the instructor you wish to meet.

Required course materials:

- *Textbook: Chemistry: Atoms First 2e, Flowers et al. OpenStax. This textbook can be read [online or downloaded as a pdf](#) for free, or purchased as a printed copy from the bookstore.*
- *Online Homework: ALEKS for general chemistry. (Included in the course fee.)*
- *Lab documents: Chemistry 105 Lab Manual Spring 2025. Available from the bookstore.*
- *Goggles: Indirect vented safety goggles (must bear the number Z87.1) are required. Available at the bookstore or from the UW Oshkosh Chemistry Club (sold at the Chemistry Stockroom HS-450).*
No goggles? No lab!
- *Calculator: Any make with scientific notation, powers, roots, and logarithms. A graphing calculator is not necessary. Cell phones and other internet-enabled devices will not be allowed as calculators on tests and quizzes.*

Course objectives and learning outcomes: CHEM 105 General Chemistry I is an Explore/Nature course (XL) in the University Studies Program. The course meets chemistry requirements for students majoring in science or engineering, or in secondary education with a natural science emphasis, as well as for students preparing for healthcare programs including chiropractic, dentistry, medicine, nursing, pharmacy, physical therapy, and veterinary medicine.

As part of a liberal arts curriculum this course has a few goals. The primary goal is to introduce students to the language and the elementary theories of chemistry, to provide training and practice in analytical reasoning and problem solving, and to serve as the basis for further studies in the sciences. This fits well into the liberal arts curriculum because it teaches skills which are generally useful and specific models that are widely applicable. Learning to use these models is extremely good practice for solving unfamiliar problems as well as thinking analytically, critically and creatively. A few of the things these models are used for are understanding the chemical reactions involved in living, the shapes of biomolecules, environmental issues such as climate change, developing new drugs, and designing solid-state electronics.

After taking this course, you should be able to:

1. Describe the make-up of matter in terms of its sub-atomic, elemental, and molecular composition.
2. Extract useful chemical information from the periodic table.
3. Use the results of quantum mechanics and models of chemical bonding to predict the structure and some properties of substances.
4. Use the concepts of atomic mass, molecular mass and concentration to quantify the amount of a substance in a sample.
5. Use abstract representations of chemical reactions combined with mathematical concepts to make qualitative and quantitative predictions and conclusions about the outcome of chemical reactions.
6. Describe the difference between real and ideal gas behaviors and perform quantitative calculations for gases that behave ideally.
7. Combine abstract representations of chemical reactions with thermodynamic information to quantitatively track energy flow and spontaneity in chemical reactions.
8. Describe how intermolecular forces impact phase transitions, solubility and adhesion.
9. Work cooperatively with others to critically analyze abstract and physical (laboratory) problems, as well as accurately record observations and data.

Course components: Each week you will have at least five ways to learn chemistry. Remember that this is a 5-credit course, so will require almost twice as much work as a 3-credit course. Success in this fast-paced and challenging course requires good attendance and a significant investment of time in addition to scheduled class hours. Since your ability to learn the later topics will depend on understanding earlier material, it is important to keep up with the schedule. Please visit the instructors during their posted office hours, or make an appointment for a different time, to clear up points of confusion or to explore topics beyond the scope of the class or textbook.

Lecture:

In lecture you will listen to descriptions of important concepts, observe methods for solving problems, take notes, and ask questions. Please bring your calculator to each lecture.

Discussion:

Class time will be spent working in small groups on exercises provided by the instructor. Occasionally, new material will be presented, which will not be re-covered in lecture, but will be on the exams and homework. Credit for Discussion will be based on participation. Attendance and honest effort on the in-class exercises will earn a 100% for the day. To allow for illness and emergency you only need credit for 11 of the 14 discussions.

Homework:

Outside of class time you will read the textbook, following the [schedule on page 9](#), and practice solving problems using the ALEKS online homework system. ALEKS is an intelligent tutoring system that will help you efficiently practice chemistry problem solving. ALEKS allows you to skip topics you already know, and directs you to practice the unfamiliar topics until you can reliably solve related problems.

When you start using ALEKS you will take an adaptive quiz called an **Initial Knowledge Check** to determine what you already know/understand. Take this Initial Knowledge Check seriously so that you do not have to work on exercises for topics you have already mastered prior to this course. Based on your performance, ALEKS will create a **Prerequisite Review** assignment with math exercises, so you will be ready to do chemistry problems.

While it is best to do some problems every day, progress on ALEKS assignments will be checked twice a week. Each assignment is called a *Module* and consists of a few topics to learn. Access to the next module starts as soon as you complete the previous one. The material for each module is too difficult to learn in one long session the night the module is due. Most students that pass general chemistry spend 4 – 8 hours spread throughout each week working in ALEKS. This work is often broken up into 20 – 40 minute blocks depending on available time and stamina.

Some modules will be followed by **Knowledge Checks**. These quiz you on topics you have already learned. Topics you remember are added to your list of **mastered** topics. Knowledge checks help you review for exams by adding topics you have forgotten back into your learning path.

Open Pie periods allow you to work on any topic for which you have learned the prerequisite topics. Open Pie is a good time to go back to old topics you have not completed, or to work ahead. There is also a review option that lets you practice topics you have mastered.

- Module: 50% of your ALEKS grade is determined by the fraction of topics you learn by each module due date.
- Topic Goal: 30% of your ALEKS grade is determined by the fraction of all the topics you learn (in your “pie”) by the end of the semester.
- Pie Progress Goal: 20% of your ALEKS grade is determined by the fraction of all the topics you **master** by the end of the semester.

Therefore, it is to your advantage to take all Knowledge Checks, and to continue working on topics you have not learned, even after the topic due date has passed.

Additional Study:

Research on successful students shows that they do more than just the required homework. You should spend additional time reading the textbook, reviewing/annotating your notes, learning vocabulary, and getting additional help on topics you do not understand. The end-of-chapter problems in the text offer useful additional practice for topics you want to work on more. Answers are provided in an appendix of the text so you can check your work. Specific problems will be suggested in the course Canvas site.

Two key things that will make your studying more effective are to read the textbook sections and start the homework before the material is covered in class. This will make class time more useful to you by helping you identify which topics confuse you, and allowing you to ask better questions. Additional study suggestions will be provided in class and on the course Canvas site.

Laboratory:

“Hands-on” laboratory work is an essential part of chemistry. In the lab you will experience directly some of the relationships discussed in the lecture, learn experimental techniques, and solve chemical problems. You will learn to use scientific instruments, to make careful observations, and to communicate your findings in written reports. Laboratory work is completed in small groups to assist students in gaining teamwork and leadership skills. Bring your lab manual, goggles, and calculator to the laboratory.

The chemistry laboratory can be a dangerous place. To minimize the chance of an accident, students must read the procedures in the lab manual and complete a prelab quiz in Canvas before coming to lab each week. A strict dress code and other safety regulations listed in the laboratory manual will be enforced. Also, anyone who is pregnant or has a history of serious allergies **MUST** inform their laboratory instructor, to discuss safety precautions **BEFORE** entering the lab to do any work.

Attendance in laboratory is mandatory. Students who must be absent due to illness or family emergency must email their instructor that they will be absent. If you miss a lab, you may attend a different lab section during the same week, if space allows. To attend another lab section, you must get permission to switch by emailing both your normal lab instructor and the instructor of the lab you will attend. Two unexcused absences from lab, or a score of less than 50% in the laboratory component, will result in a failing grade for this course, regardless of exam scores.

Peer Educator Sessions (optional): A peer educator, who is a student who has successfully completed Chem 105 and 106, will offer problem-solving sessions. More details will be announced in a first week’s lecture.

Tutoring (optional): The UW Oshkosh Center for Academic Resources offers free, confidential tutoring to all UWO students in the Student Success Center, suite 102. Check their website www.uwosh.edu/car for more information or to contact a tutor. Many students have used this in the past and found it extremely helpful!

Exams: Five exams will be given during class time. Exams will be primarily multiple choice with no partial credit. Each exam will contain questions on material covered in the weeks preceding the exam. Much of the material in the class is cumulative, and you will need to use material tested on earlier exams to answer more sophisticated questions asked on later exams. Additionally, [core topics](#) from earlier exams will be reviewed on later exams. More information on the core topics can be found on page 8 of this syllabus.

	in Classroom During Lecture	Number of Questions
Exam 1	Thursday, February 27	30 (all new material)
Exam 2	Thursday, March 20	35 (30 new material + 5 core topic review)
Exam 3	Thursday, April 17	35 (30 new material + 5 core topic review)
Exam 4	Thursday, May 15	30 (all new material)
Exam 5	in Lab week of May 12	20 (all core topic review)

All exam questions are weighted equally. The computer scan sheets for multiple choice exams will not be returned to you. Make sure that you record your answers on the exam as well as the scan sheet. You must check the posted answer keys to verify that your score was entered properly.

Do bring your calculator, pencil and eraser. No cell phones, radios, MP3 players, headsets or other recording or transmitting devices may be used during exams. Caps with bills must have bills turned to back of head.

Early exams will be offered for students who cannot attend the exam during the scheduled day. Students who need to take early exams must sign up with the instructor the week before the exam.

Accommodations:

The University of Wisconsin Oshkosh supports the right of all enrolled students to a full and equal educational opportunity. It is the University's policy to provide reasonable accommodations to students who have documented disabilities that may affect their ability to participate in course activities or to meet course requirements. Reasonable accommodations for students with disabilities is a shared instructor and student responsibility. Students are expected to inform instructors of the need for accommodations as soon as possible by presenting an Accommodation Plan developed with the Center for Accessibility and Disability Resources, which is located in Clow N201. For more information, email accessibilitycenter@uwosh.edu and/or projectsuccess@uwosh.edu, call 920-424-1033, or visit the [Accessibility Center Website](#).

Attendance Policy: Regular attendance is essential to success in this course. Students are expected to attend every scheduled class but will be excused for illness, family emergencies, and required University sanctioned activities. Assignments and exams missed for a valid reason will not be counted against you, but you will be responsible for material covered in your absence. If you need to miss a lab or exam, send an email message to your instructor. Advance notice of a pending absence will often make it possible to arrange for an alternate time for an exam or attendance in another lab or discussion section. Due to the

administrative complexity of this large course, there are no makeups for exams. If you miss more than one exam, for any reason, you will receive an incomplete or a failing grade, depending on the circumstances.

Grading:

Grades will be determined by the weighted points earned in course activities, except that students earning less than 50% of the lab points will receive only F or Incomplete. The relative weightings of assignments are

Exams (5).....	52%	Laboratory score components:
Laboratory.....	23%	prelabs.....
ALEKS Homework.....	15%	notebooks.....
Discussion	10%	quizzes.....
Total.....	100%	

Grading Scale

The minimum percentage necessary for each grade range is listed below. These cutoffs will not be adjusted upward, but the instructors reserve the right to lower them.

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
Minimum %	91	88	83	79	74	70	66	62	58	54	52	0

Grades will be posted in Canvas as they become available, so you may check your current course grade at any time during the semester. It is your responsibility to verify that all scores are entered properly. Misgraded assignments or exams must be returned to your instructor for possible regrading no later than one week following their return to you. You are responsible for checking that your final score is correct. Save all work until the final course grade has been determined.

Early Alert email messages will be sent during the third week if poor attendance is causing problems, and/or if your grade is below a C. If you have any concerns about your performance in the course, please contact your instructor to discuss possible ways to improve the situation.

Additional Course policies

Classroom Decorum:

Be courteous to your fellow classmates. While pertinent questions are encouraged, talking and whispering during lecture are disruptive and annoying to nearby students trying to listen to the lecture. Cell Phones must be silenced and put away except when using them to respond to in-class questions. This means absolutely no “texting” during class.

Computers may be used to take notes, but do not use them for e-mail, videos, game playing, etc. during class as it is disruptive and annoying to nearby classmates trying to listen to the lecture.

E-mail etiquette:

Your instructors will happily respond to your emails as fast as they can. Please be sure to include “CHEM105:” at the beginning of your subject line, so that we know what the email is referring to. In the body include as much information as you can provide about what you are asking, and your name. Instructors will try to answer emails within 1 business day. If an instructor does not reply within 1

business day, there is a chance that they missed your email, so please forward the email again. We do not respond to emails that include “text speak”.

Academic Misconduct:

The University of Wisconsin-Oshkosh is built upon a strong foundation of integrity, respect, and trust. All members of the university community have a responsibility to be honest and the right to expect honesty from others. Any form of academic dishonesty is unacceptable to our community and will not be tolerated.

As college students (and adults) you are expected to observe high standards of integrity and honesty. Representing the work of another as your own is considered academic misconduct. Any assignment (exams) which you are required to do individually should contain only your own work. Students caught cheating on exams, quizzes, or in the laboratory are subject to a grade of F for the assignment and a report being placed in their academic records. A second offense is likely to result in expulsion from the University. For more details see the [information on the Dean of Students Office website and the portions of Wisconsin State Law referenced there](#).

Other Useful Information

RESPECTING THE DIVERSITY OF OUR COMMUNITY: Diversity drives innovation, creativity, and progress. At the University of Wisconsin Oshkosh, the culture, identities, life experiences, unique abilities, and talents of every individual contribute to the foundation of our success. Creating and maintaining an inclusive and equitable environment is of paramount importance to us. This pursuit prepares all of us to be global citizens who will contribute to the betterment of the world. We are committed to a university culture that provides everyone with the opportunity to thrive. Therefore, all members of our community are expected to treat each other with respect and apply intellectually rigorous critical analysis to all their interactions with others (e.g. activities, discussions, arguments, etc...).

STUDENTS RIGHT TO KNOW ACT OF 1990: Students are advised to see the following URL for disclosures about essential consumer protection items required by the Students Right to Know Act of 1990: <https://uwosh.edu/financialaid/consumer-information/>.

THERE ARE LOTS OF SUPPORT SERVICES ON CAMPUS: If you have an emergency, mental health issue, suffer harassment, have food insecurity, ... , see the campus resources information in the class Canvas site.

Topics List: This identifies the sections you should read before attending class and attempting the associated homework. See the [course calendar](#) (page 10) for the expected dates that topics will be addressed in class.

Week Beginning	Topics (numbers are sections to read in OpenStax text)
2/3	1.1 – 1.4: Chemistry in Context, Classification of Matter, Physical and Chemical Properties, Measurements, Significant Figures 2.1 – 2.4: Atoms, Ions, Formula 20.2, 20.4: Introduction to Nuclear Reactions and Isotopes
2/10	3.1 – 3.5: Light (electromagnetic energy), Electronic Structure of Atoms, Periodicity
2/17	3.6 – 3.7: Periodicity, Intro to Ionic vs. Molecular Compounds 4.1 – 4.3: Ionic and Covalent Bonding, Naming Binary Compounds
2/24	1.5 – 1.6: Treatment of Measurements Exam 1
3/3	6.1, 6.3: Moles, Formula Mass, Molarity 7.1 – 7.4: Chemical Reactions: Balancing, Classification, Stoichiometry.
3/10	7.5: Yields, Quantitative Chemical Analysis 8.1 – 8.3, 8.5: Gases, Ideal Gas Law, Stoichiometry through Gas Density and Molar Mass, Kinetic-Molecular Theory
3/17	8.6: Non-ideal Gases Exam 2
3/24	<i>Spring break</i>
3/31	4.4, 4.5: Lewis Structures, Formal Charge, Resonance
4/7	4.6: Molecular Shapes (VSEPR), Polarity 5.1 – 5.3: Intro to Valence Bond Theory, Hybrid Orbitals, Multiple Bonds
4/14	21.1: Organic Chemistry introduction, hydrocarbons (condensed and skeletal structures, shapes, hybridization; <i>not responsible for</i> functional groups). 9.1 – 9.3: Energy, Calorimetry, Enthalpy through Thermochemical Equations
4/21	9.4: Strengths of Ionic and Covalent Bonds Exam 3
4/28	10.1 – 10.4: Intermolecular Forces, Liquid Properties, Phase Transitions
5/5	10.5 – 10.6, 12.1 – 12.3: Solids, Crystalline Solids, Spontaneity, Entropy
5/12	12.4: Free Energy Exam 4, Exam 5

Core Topics

The topics and skills listed below are fundamental to being able to use the material in this class in courses for which it is a prerequisite, in related areas such as biology and healthcare, and understanding how the physical world around you behaves. This is not a complete list of all the material you will learn about in this course. However, because they are important scaffolding for this and future courses, you will be tested on them repeatedly throughout this course.

Exams 2, 3 and 5 will contain questions reviewing core topics that were learned for previous exams. This will allow you to get credit for learning the topic later than the exam for which it was covered in class. Exam 5 will have questions related to all the topics on this list, allowing you to earn credit for learning any core topics you missed earlier in the class.

Covered before Exam 1:

1. Use the periodic table to find information about an element's atomic structure and number of valence electrons.
2. Based on chemical formula, determine if a compound is ionic or covalent.
3. Starting with formula, determine charges in ionic compound.
4. Know the formulas and charges of common polyatomic ions. Recognize these in chemical compounds.
5. Know the formulas and names of common strong acids and bases.
6. Know metric prefixes (mega, kilo, centi, milli, micro, nano) and calculate metric conversions (ex: milligram to kilogram).
7. Identify the number of significant figures/digits in a measurement and propagate significant figures/digits through calculations involving +, -, x and \div .

Covered before Exam 2:

8. Calculate molar mass based on chemical formula.
9. Interconvert mass and moles, labelling units correctly in calculation.
10. Interconvert Molarity and moles, labelling units correctly in calculation.
11. Dilution calculation (new concentration, final volume or solvent to add).
12. Write equations for acid-base and dissolution reactions.
13. Use the periodic table and oxidation number rules to assign oxidation numbers to atomic ions and elements in a compound. Note: for atomic ions the oxidation number and ionic charge are the same.
14. Balance a chemical reaction.
15. Use a chemical reaction to relate moles of reactants and products.
16. % yield calculations/limiting reagents.

Covered before Exam 3:

17. Starting with chemical formula, draw Lewis structure.
18. Determine chemical formula from a skeletal structure.
19. Determine the hybridization and VSEPR shape from a Lewis structure.
20. Identify π and σ bonds. Groups connected by only σ bonds can rotate relative to each other.

Covered before Exam 4:

21. Use Lewis structures to predict intermolecular forces acting in a sample.
22. Calculate $\Delta H^{\circ}_{\text{rxn}}$, $\Delta G^{\circ}_{\text{rxn}}$ and $\Delta S^{\circ}_{\text{rxn}}$ from thermodynamic tables.

LECTURE, DISCUSSION, AND HOMEWORK CALENDAR

Week of	Discussion (Monday)	ALEKS (Monday)	Lectures (Tuesday)	Lectures (Thursday)	ALEKS (Thursday)	ALEKS Knowledge Check	Lab (Tue- Thu)
2/3	1.2-3	----	1.1, 1.4	2.1-4 20.2, 20.4	Initial Knowledge Check		<i>no lab</i>
2/10	Ionization energy	Prerequisite Review	3.1-3	3.4-5	Module 1		Atomic emission
2/17	Electron configuration	Module 2	3.6-7 4.1-2	4.3	Module 3	Knowledge Check 1	Periodic properties
2/24	Bond types	Module 4	1.5-6	EXAM 1 (through 4.3)	Module 5		Meas. and sig. fig.
3/3	Balancing equations	----	6.1, 6.3, 7.1-2	7.3-4	Module 6		Acid base titration
3/10	Stoichiometry	Module 7	7.5, 8.1-2	8.3, 8.5	Module 8	Knowledge Check 2	Gases
3/17	Gases	Module 9	8.6	EXAM 2	Module 10		Cu transf. 1
3/24	<i>Spring Break</i>						
3/31	Lewis structure	----	4.4	4.5	Module 11		Cu transf. 2, quiz 1
4/7	Molecule shape	Module 12	4.6	5.1-3	Module 13		Absorp. of light
4/14	Organic	Module 14	21.1, 9.1	9.2-3	Module 15	Knowledge Check 3	Thermo 1
4/21	Enthalpy	Module 16	9.4	EXAM 3	Module 17		Thermo 2
4/28	IMF	----	10.1-2	10.3-4	Module 18	Knowledge Check 4	Dyes and Fibers
5/5	Phase changes	Module 19	10.5-6	12.1-3	Module 20	Knowledge Check 5	checkout, quiz 2
5/12	Thermodynamics	Module 21	12.4	EXAM 4	Module 22		EXAM 5

* Last date to drop this course without a Late Add/Drop Request Form: Wednesday, March 19, 2025. Students dropping the course must check out of lab before the drop is considered complete.

Discussion meeting times:

Section	Instructor	Location	Mondays	Section	Instructor	Location	Mondays
A01D	Dr. Foley	Halsey 212	9:10-10:10	A04D	Dr. Crawford	Halsey 212	1:50-2:50
A02D	Dr. Foley	Halsey 212	10:20-11:20	A05D	Dr. Crawford	Halsey 212	3:00-4:00
A03D	Dr. Foley	Halsey 212	11:30-12:30				

LAB SCHEDULE

Week Beginning	Prelab due 8am on lab day	Lab Assignment
2/3		<i>no lab meetings</i>
2/10	Prelab due	1. Check-in, Safety, Atomic Emission
2/17	Prelab due	2. Periodic Properties
2/24	Prelab due	3. Measurements, Significant Figures & Density
3/3	Prelab due	4. Acid Base Titration
3/10	Prelab due	5. Properties of Gases
3/17	Prelab due	6. Transformations of Copper 1
3/24		<i>no lab meetings (spring break)</i>
3/31		6. Transformations of Copper 2, LAB QUIZ 1
4/7	Prelab due	7. Absorption of Light
4/14	Prelab due	8. Thermochemistry 1
4/21	Prelab due	9. Thermochemistry 2
4/28	Prelab due	10. Dyes and Fibers
5/5		Checkout, LAB QUIZ 2
5/12		EXAM 5

Lab meeting times (all meet in HS 404):

Tuesday	Wednesday	Thursday
	8:00 – 10:10 AM A01L Dr. Crawford	
	10:20 AM – 12:30 PM A02L Dr. Tang	
1:20 – 3:30 PM A03L Dr. Mihalick	1:50 – 4:00 PM A04L Dr. Gutow	12:40–2:50 PM A05L Dr. Foley