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Chem 177 Chemistry Department Homepage: <https://www.chem.iastate.edu/course/2025/spring/chem-1770>

Canvas: <https://www.celt.iastate.edu/learning-technologies/canvas-isu/>

Top Hat: <https://success.tophat.com/s/>

*Chem 1770 and 1770L/1770N are co-requisite courses, i.e., students in Chem 1770 are required to take Chem 1770L/1770N at the same time or to have already received credit in 1770L/1770N. If you do not fulfill these requirements, you will not get credit for Chem 1770. Students who drop or audit Chem 1770 will be required to drop 1770L/1770N and vice versa. Students may not register to audit Chem 1770 after 5:00 PM on Monday, February 3, 2025. The audit does not count towards full-time student status. **To add or drop recitation or lab sections during the first week of class, use WorkDay. After the first week, please go to the Undergraduate Chemistry Office in 1608 Gilman (M-F 8 – 11:50 am and 1 – 5 pm).** The last day to change the course to pass/not pass or to drop CHEM 1770 is Friday Apr. 4th, 2025.*

Required Textbooks & Supplies: *Chemistry* (11th Edition), Zumdahl, Zumdahl, DeCoste (2024), Cengage: Boston. This book is part of the **Inclusive Access** program at Iowa State, which means that by enrolling in this course you will have the e-book version and the electronic homework included as part of your U-Bill. By using this option, the book and homework comes at a much lower price than other textbook/homework options.

Top Hat Response Technology:

We will begin using a response system based on your phone or tablet on day two of class. We will be using the Top Hat (www.tophat.com) classroom response system in class. You will be able to submit answers to in-class questions using smartphones, tablets, laptops, or through text messaging. You can visit the Top Hat Overview (support.tophat.com/hc/en-us/articles/200019034-Top-Hat-Overview-Getting-Started) within the Top Hat Success Center which outlines how you can register for a Top Hat account, as well as provides a brief overview to get you up and running with the system. An email invitation to join your Top Hat space will be sent to you by Prof. Holme, but if you don't receive it, you can still create your student account at tophat.com. The Top Hat license is campus wide so you don't need to purchase an individual license to access any quizzes or questions created in the Top Hat system. TopHat use in this class is just to provide you the change to think about the content being presented and for Prof. Holme to see if the content is being learned. There are no points associated with participating with TopHat during lecture. Should you require assistance with Top Hat at any time please contact the IT Solution Center at 515-294-4000 or solution@iastate.edu.

Nonprogrammable scientific calculator (with $\ln x$, e^x , $\log x$, 10^x , y^x functions). Calculators with graphing and text capabilities may not be used during exams and quizzes. All calculators are subject to inspection during exams and quizzes; improper calculators may be temporarily confiscated. Bring your own calculator to class and recitation. Your mobile phone cannot be used as a calculator on a test.

OWL V2: OWL V2 is an online homework and tutorial system that is associated with our textbook. Because we have Inclusive Access you **SHOULD NOT** buy an "access code" for OWL V2. You already have access by signing up for this course (as long as you haven't taken actions to override the Inclusive Access billing on your UBill.) You will be able to access the Homework, the ebook and a set of "animations" associated with the book directly from the Canvas page for the course. The homework assignments you see are specifically for students in the MWF 12:05 PM class in Gilman Hall. The first assignment to get familiar with OWL does not count for points, and is due **Sunday, January 26 at 11:59 PM** and the first book homework for Chapter 1, which does count for points, is also due on **Sunday, January 26 at 11:59 PM**. Step by step instructions for registering in the OWL and joining the course are posted on *Canvas (Course Content)*. OWL homework assignments are worth 8 points each. There will be 11-12 of them and you will have your score based on your top 7 scores.

The textbook company who markets OWL (Cengage) will have a representative on campus the first week of classes to help students get it working correctly. We will keep you informed on Canvas about when and where they are available. It is your responsibility to get the help you need to get your access to the homework correctly working.

Overall Theme: A key premise of this course is the importance of connecting chemistry to Earth and societal systems. For this semester in this section of the course the connections will be associated with carbon footprints, water footprints and embodied carbon. Examples of these connections will appear regularly in the course and activities including tests may assess learning about them.

Lectures:

This section for Prof. Holme's Chem 1770 course meets at 12:05 pm in Troxell Hall 1001. Students are expected to attend lecture and are responsible for knowing information that is provided in announcements that are given at the beginning of each lecture. Participation in lecture is enhanced via the Top Hat response system with questions that may occur at any time in the class. You need a Top Hat account and to bring your device (probably your smart phone) with you to every lecture. When learning new content, it's OK to make some mistakes – the key is to learn from them. That's why TopHat questions are helpful in class. For example, where a number of students choose the incorrect answer, I may review concepts immediately in class. For those questions where most students have a correct answer but there's still some confusion apparent among the class, a discussion of the question will be available as a recording on Canvas sometime after class.

Lecture capture is part of the facilities in 1002 Gilman, so you will be able to review class afterwards. The capture does NOT show what gets written on the chalkboards very well, however, so it provides a good way to review things that you may have missed, but is not 100% of the in-class experience. Prof. Holme also posts PDF versions (with some missing information) of his lectures BEFORE class, so you annotate those slides on printouts or on tablets, etc. A version of the full slides will get posted later in the afternoon the day of the lecture.

There is significant research that shows students who have computers open in class, even those who are trying hard to take notes on those computers, generally have lower performance in the class. Importantly, there is also evidence that students who sit near students with open computers are also adversely affected by the possibility of distraction. This aspect of device note-taking is not a problem for tablets that lay flat on the desktop. Given these research observations, Prof. Holme does not forbid computer-based note taking in class. He will, however, be open to limit where people who are using screen-up computers in lecture may sit if there are classmates who wish to avoid distraction so they can find seats where computers are not open. The specific geography of this system will be explained if it is invoked.

Recitation: On Thursdays you will meet in smaller groups with a teaching assistant (TA); **attendance is expected** at all recitation sessions. Recitation sessions will be used to discuss questions, work some end-of-chapter problems, and discuss ways in which the chemistry content connects to other science courses and to real-world issues. Discussion sections will have worksheets handed in roughly 40% of the time, and the sessions with hand-in worksheets will be noted before hand during the pre-lecture announcements in class, so they are known in advance. Another roughly 40 percent of the time there will be group work on concept maps that will serve as a way to work on the conceptual aspects of chemistry covered in the course. Athletes and students who are away from campus for ISU games, matches, or club trips and cannot attend a recitation where a quiz or concept map exercise occurs must discuss their options with Prof. Holme as soon as possible. Much like scoring for the OWL homework there will be 11 or so worksheets or concept maps handed in at discussion section times. They too will be worth 8 points each and your top 7 scores will be used in the course.

Late assignments or missed discussion usually do not receive any points, but the number of dropped scores with only 7 top scores counted is generally adequate for having an occasional missed assignment or discussion section not have a serious affect on your overall score in the course.

Writing Assignment with a Concept Mapping Alternative

Writing Assignment: Communication skills are routinely listed by companies who hire scientists and engineers as one of the most important and yet often underdeveloped skills that they seek in new employees. Therefore, Prof. Holme has at least one short writing assignment in all of his classes, even ones as large as Chem 177. In this case, the writing assignment will be associated with applying principles we learn in chemistry to problems of sustainability. Considered broadly, *sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of **present and future generations***. Science and engineering play an important role in building sustainability, and chemistry in particular provides the **molecular basis for sustainability**. We will focus on the ways molecular understanding is needed to address sustainability throughout the semester.

The writing assignment **will be brief**, because Prof. Holme must read them all to grade them. **Therefore, these written assignments may not be any longer than 500 words**. You need to include a bibliography, and those words do not count in the 500-word maximum. An important part of this assignment is deciding on an appropriate topic under the general heading of “energy and water demand in things we use in everyday life”, one that will be capable of being described reasonably in such a short paper. The final draft of the paper is due **April 7 at 11:59 PM**. For the purpose of the writing assignment we will focus on the concepts of carbon footprint (related to energy), water footprint or embodied carbon. We will approach this idea by introducing some aspects of “systems thinking” and identifying how we can think about the chemical composition of things we encounter in everyday life. The writing assignment itself requires you to cover at least two aspects of any one of the three areas (carbon footprint, water footprint or embodied carbon). There is not a rubric for scoring the paper. You need to write your paper to Dr. Holme, and present a convincing level of detail about your choice of topic that indicates you know what you are writing about and why it’s important to know about it. More details and guidelines about the writing assignment will be given in announcements in lecture. Writing assignments are submitted through Canvas and will automatically be checked for plagiarism. Cases of plagiarism are considered a form of academic misconduct.

I realize that not every student is going to find writing a 500-word paper as the best way for them to demonstrate their understanding of a chemistry/science topic. Thus, there is an alternative way to approach this assignment that will leverage how we learn about using concept maps. The tool is called a Systems Oriented Concept Map Extension (SOCME). These visualization tools will allow you to note conceptual connections among chemistry content AND connections to larger issues related to sustainability. We will have tutorial materials on the Canvas page for those interested in learning how to build a SOCME diagram about the chemistry concepts associated with one of the areas (carbon footprint, water footprint or embodied carbon) and additional connections to subsystems such as energy usage or the release of carbon dioxide into the atmosphere as part of the production of goods we use in society.

Exams: In addition to the Final Exam (given Monday, May 12 at Noon during finals week), there will be **3** exams held in class, scheduled as shown in the calendar on the last page of this syllabus. Exams will have multiple-choice questions. Exams that are missed will be made up using “resurrection points” based on performance on the same content on the final as was assessed on the missed exams. Athletes and students who are away from campus for ISU games, matches, or club trips and cannot take the exam as scheduled, must discuss their options with the instructors as soon as possible.

Resurrection Points: The idea behind resurrection points is that if materials that is not completely known at the time of an hour exam, is known by the time of the final exam and performance on the final exam reflects that knowledge, every student can earn back missed points for each exam. The final exam has 4 sections, Section A = test 1 content; Section B = test 2 content, Section C = test 3 content and Section D is content covered after test 3. As an example, if you scored a 74 on test 2 (that is 82.2%) and then 36 out of 40 points on Section B of the final (that is 90%) you would receive 7 points for that exam (because 90% of 90 points of the hour exam is 81 and 81 is 7 points higher than 74.) As noted above, this also works for making-up missed exams, as the score calculated from the percentage correct on the final provides the number of resurrection points that is equal to what serves as the score on the final. Resurrection points are the only way to make up points due to a missed exam, independent of the reason the exam was missed.

If at all possible, exams will be returned to students during the recitation session on the Thursday following each exam (held on the prior Wednesday). **The General Chemistry Office will not give out individual exams or scores.** Any requests for regrades must be submitted at the recitation where the exam is returned to students. A test paper handed in for regrade may have any question regraded, and students may gain or lose points in the regrading process. **Language translators and dictionaries are not allowed during quizzes and exams.**

Accessibility: Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. Students requesting accommodations for a documented disability are required to work directly with staff in Student Accessibility Services (SAS) to establish eligibility and learn about related processes before accommodations will be identified. After eligibility is established, SAS staff will create and issue a Notification Letter for each course listing approved reasonable accommodations. This document will be made available to the student and instructor either electronically or in hard-copy every semester. Students and instructors are encouraged to review contents of the Notification Letters as early in the semester as possible to identify a specific, timely plan to deliver/receive the indicated accommodations. Reasonable accommodations are not retroactive in nature and are not intended to be an unfair advantage. Additional information or assistance is available online at www.sas.dso.iastate.edu, by contacting SAS staff by email at accessibility@iastate.edu, or by calling 515-294-7220. Student Accessibility Services is a unit in the Dean of Students Office located at 1076 Student Services Building.

Academic Misconduct: The class will follow Iowa State University's policy on academic dishonesty. Prof. Holme will follow the standard misconduct reporting protocol for anyone suspected of academic dishonesty working with the [Dean of Students Office](#). See the Conduct Code at <https://www.policy.iastate.edu/policy/SDR#4.0> for more details and a full explanation of the ISU Academic Misconduct policies.

Grades: Your course final grade is based on

- 3 in class tests (270 pts total),
- OWL homework (56 pts) – top 7 homeworks counted,
- Worksheets and concept maps from recitation (56 pts) – top seven discussion activities counted
- Writing assignment (or SOCME alternative) – 78 pts, and
- the Final exam (140 pts)
- for a total possible 600 points.

Based on this amount of available points, following letter grade scale will be used to give your final letter grade:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
Above 560	540-559	520-539	495-519	470-494	445-469	420-444	390-419	360-389	330-359	300-320	Below 300

Important: These cutoff scores are expected to lead to a grade distribution that will be consistent with prior semesters and other sections of Chem 1770 in this semester. Students near grade borderlines (typically within 2 points) are explicitly checked to determine if a higher grade is warranted – but even in these cases students often do not receive the higher grade. I will check TopHat participation in class for students at the borderline. Students who do not engage in the lecture as noted with TopHat answers are less likely to be bumped up to the higher grade.

Once established your final letter grade is NOT negotiable; once the final exam has been taken, there is no other way to obtain more points. Extra credit points are very unlikely in this course, but if they are offered, the activities will occur during the semester and will be made available to ALL students – individual requests to do extra credit cannot be granted.

Important Course Policy: It is the student's responsibility to check grades on Canvas. Any student who discovers an error in a grade on Canvas must contact the teaching assistant and bring the graded work to their TA **within 1 week** of receiving the returned graded work to have the grade corrected.

Resources: Important announcements, previous semesters' hour exams, this syllabus, lecture notes, and exam review sheets, as well as other useful information are posted on Canvas. Throughout the semester items will be added to Canvas. Deadlines are always noted in the pre-class "Keeping Track" sheet that is up before lecture starts, and is captured in lecture capture, so that is the authoritative source of deadlines. I will try to check that deadlines in Canvas appear and are accurate, but Canvas is NOT always a 100% reliable source for deadlines, so it is important to check out the "Keeping Track" sheet posted on the document camera when you arrive at class to make sure you are aware of what deadlines are getting near.

Chemistry Help Center: Teaching assistants are available in the **Martha E. Russell Chemistry Help Center and Resource Room, room 1761 Gilman**. This Center is staffed by general chemistry teaching assistants and is open M – R, 9 – 5, and F, 9 – 1. Answers to all previous quizzes and previous exams are on file in the Center. Resources in the Help Center are not to be removed from the room. For more help, visit Prof. Holme during his office hours.

Supplemental Instruction (SI) sessions and materials are provided by the Academic Success Center and are prepared by the SI leaders. They are not provided by the course instructors, but I will work with the SI instructors to help them provide high quality help particularly for the problems solving aspects of this class.

How to e-mail your Chem 1770 Instructors: Email is often not a particularly rapid way to communicate, but Prof. Holme does make every effort to respond to emails. It is best to use chem1770-2q@iastate.edu as the email address because both Prof. Holme and the head-TA will check that email. In addition, your TA will fill you in about email availability when you meet them in Discussion. In many cases, you may have questions that other students can answer, and an email to instructors is not needed, so there will be alternative communication avenues associated with this course. Perhaps the best way to get quick answers are "Discussion Boards" within Canvas. Prof. Holme will help build some useful discussion threads, and he does monitor them as well and will step in to clear up confusion when he sees it.

Problems and Questions: Please check on *Canvas* to see if your question or issue can be answered by looking through this syllabus. If you are having issues with **Canvas** or the electronic grade-book, contact your recitation TA directly. If you are having issues with **OWL V2**, visit: <https://www.cengage.com/student-training/owlv2/canvas/ia-yes/> (if the issue is not resolved with the OWL support, then please contact Prof. Holme with the detailed description of the issue and he can try to contact Cengage for additional help). Note that we will not be able to solve technical issues such as registration, access to the internet, etc. You are however encouraged to let me know if you are unable to complete an assignment due to technical difficulties.

Free Speech: Iowa State University supports and upholds the First Amendment protection of [freedom of speech](#) and the principle of [academic freedom](#) in order to foster a learning environment where open inquiry and the vigorous debate of a diversity of ideas are encouraged. Students will not be penalized for the content or viewpoints of their speech as long as student expression in a class context is germane to the subject matter of the class and conveyed in an appropriate manner.

Harassment and Discrimination: Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3410 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515-294-7612, Hotline 515-294-1222, email eooffice@iastate.edu

Religious Accommodation: Iowa State University welcomes diversity of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request the reasonable accommodation for religious practices. In all cases, you must put your request in writing. The instructor will review the situation in an effort to provide a reasonable accommodation when possible to do so without fundamentally altering a course. For students, you should first discuss the conflict and your requested accommodation with your professor at the

earliest possible time. You or your instructor may also seek assistance from the [Dean of Students Office](#) at 515-294-1020 or the [Office of Equal Opportunity](#) at 515-294-7612.

Course Goal/Learning Outcome: Upon successful completion of this course, students will have mastered fundamental concepts in general chemistry and will be able to successfully approach Chem 178 (the second half of our general chemistry course). Chem 177 will allow the student to pursue upper level chemistry courses as well as specialized studies in other fields of science and engineering.

Learning Objectives: Learning objectives for this course are built with three aspects in mind (they are sometimes called tri-partite learning objectives as a result. The idea is that when we consider chemical skills and concepts we need to know (a) what they are; (b) how we know them; and (c) why they matter. The specific tri-partite learning outcomes are:

Knowledge: What We Know	Evidence: How We Know It	Relevance: Why It Matters
1K: Benefits and risks of chemicals Explains the concept of “the dose makes the hazard”	1E: How are toxicity and exposure measured?	1Ra: At what level is risk acceptable? 1Rb: We have to make decisions about chemicals and their use.
2K: Solve chemical problems with scientific data (graphical or tabulated data)	2Ea: Graphical and tabulated data come from measurements 2Eb: Measurements have precision and accuracy associated with instruments 2Ec: Error must always be kept in mind	2Ra: Need to be able to know which chemicals are more dangerous than others 2Rb: Need to know if ways to measure are adequate to use the chemical knowledge
3K: Describe fundamental components of chemical structure	3E: Mass spectrum shows molecular ion peaks, number of isotopes, and the relative abundances	3R: Differences in isotopes can cause changes in physical and chemical properties of a chemical, thus changing their uses and applications
4K: Explain fundamental features of chemical reactions (balanced equations, stoichiometric problems involving moles, mass, # of molecules, limiting reactant, theoretical yield, and % yield)	4E: The method of continuous variation is an example of a way of knowing stoichiometric ratios	4Ra: Knowing amounts of reactants can lead to methods to reduce waste – <i>green chemistry</i> . 4Rb: Societal instances of reactions, like wildfires, are often more complex than in the controlled environment of a lab.
5K: Explain chemical reactions in solution (precipitation, acid-base, redox)	5Ea: Observable to the eye changes (like color change) are not the only ways of identifying and quantifying reactions. 5Eb: Modern titrations include pH or conductivity measurement (or other electrochemical measurements)	5Ra: We need to know trace contaminant levels in air or water because of health and environmental consequences. 5Rb: Combustion is a key example of a redox reaction
6K: Describe the role of chemistry in water resources for human use and the importance of water for sustainability	6E: Instruments (from pH, conductivity, oxygen meters to chromatographic instruments) and analytical techniques allow	6Ra: Changing climate patterns play a role in where and when rain occurs and the resultant availability of water.

	purification and quality measurement of water	
7K: Explain the central role of energy in chemistry and chemical reactions (measurement of energy using calorimetry)	7Ea: Calorimetry allows the measurement of heat involved in a chemical reaction (heat transferred to or from a substance) 7Eb: Measures of energy transformation efficiency (heat to work) are a key part of using chemistry for energy	7Ra: Combustion and energy from wildfires to automotive engines 7Rb: Food sciences and dietary energy
8K: Describe atomic structure and its importance in understanding chemistry	8Ea: Characteristic chemical and physical properties can be observed, measured, and then modeled using a combination of spectroscopy and quantum models 8Eb: Historic experiments such as photoelectric effect	8Ra: Atoms are building blocks of matter 8Rb: Atomic structure explains different chemical and physical properties of matter (e.g. periodicity)
9K: Explain the origin and implication of chemical bonding	9Ea: Concept of valence can be measured 9Eb: Strengths of interactions of atoms and molecules in materials can be measured	9Ra: How do different strengths of interaction lead to different properties that can be used? 9Rb: Epoxy vs. glue (bonding vs. intermolecular forces) 9Rc: Biochemicals of plants
10K: Describe fundamental characteristics of molecules and molecular bonding	10E: Spectroscopic measures that inform our understanding of molecular scale and bulk properties	10R: Oxygen is present in combustion and its importance can be understood in terms of its bonding.
11K: Explain characteristics of gases and how they are different than condensed forms of matter (liquids and solids)	11Ea: There are measures that are not dependent on the identity of the gas and others that are dependent on the identity. 11Eb: Measures of bulk vs. molecular properties (e.g. measuring pressure/temperature vs. spectroscopic properties)	11R: Understanding the behavior of the Earth's atmosphere depends on both common gas behaviors (ideal gases as a model) and unique gas behaviors (what makes something a greenhouse gas).
12K: Explain the concept of intermolecular forces	12E: Measurements of viscosity, surface tension, phase changes	12Ra: Chemical basis of life such as how cells are organized is closely tied to the nature of intermolecular forces. 12Rb: Understanding how coronaviruses infect cells and variants change the process.

Dates	Textbook Chapter Coverage	Deadlines and activities
Jan 21 - 24	Ch. 1: Chemical Foundations Ch. 2: Atoms, Molecules and Ions	Get Textbook and OWL access Get TopHat registered for Chem 177 TopHat in class counts for points (Aug 30)
Jan 27 – 31	Ch. 2: Atoms, Molecules and Ions	
Feb 3 – 7	Ch. 3: Stoichiometry	
Feb 10 – 14	Ch. 3: Stoichiometry	
Feb 17 – 21	Ch. 4: Solution Stoichiometry	Test 1: Feb 19 (in class)
Feb 24 – 28	Ch. 4: Solution Stoichiometry	
Mar 3 – 7	Ch. 5: Gases	
Mar 10 – 14	Ch. 5: Gases Ch. 6: Thermochemistry	
Mar 17 – 21	Spring Break – No Classes	
Mar 24 – 28	Ch. 6: Thermochemistry	Test 2: Mar 26 (in class)
Mar 31 – Apr 4	Ch. 6: Thermochemistry Ch. 7: Atomic Structure and Periodicity	
Apr 7 – 11	Ch. 7: Atomic Structure and Periodicity Ch. 8: Bonding General Concepts	Paper/SOCME due (Canvas Submission) April 7, 11:59 pm
Apr 14 – 18	Ch. 8: Bonding General Concepts	
Apr 21 – 25	Ch. 8: Bonding General Concepts Ch. 9: Covalent bonding orbitals	Test 3: Apr 23 (in class)
Apr 28 – May 2	Ch. 9: Covalent bonding orbitals	
May 5 – 9	Ch. 10: Intermolecular Forces, Liquids and Solids	
May 12 - 16	Final Exam: A 2-hour comprehensive final exam will be scheduled at the time during the week of May 12–16 that is associated with our class time. We have a relatively nice time slot for our final of Noon – 2:00 PM on Monday, May 12 . More information about the final will be provided as we get nearer to finals week.	

* Students who have three or more finals on the same calendar day may request to reschedule a final. The instructor of the course having the smallest number of students is responsible for arranging an alternate examination time for the student unless make-up exam times are available in one of the other courses. To reschedule, the student must notify the instructor prior to the last day of class before the beginning of prep week so the instructor has time to make appropriate arrangements.