

Northeastern University
CHEM 1151: General Chemistry for Engineers (Honors)
Fall 2026

This course has a **co-requisite**: CHEM 1153, Recitation for CHEM 1151

Welcome!

Welcome to Chem 1151! And for most of you, welcome to Northeastern! I really enjoy teaching this class, and I hope you'll enjoy taking it. Chem 1151 has the reputation of being a really challenging course, and I suspect that many of you will find that to be the case. It moves very quickly, and it covers a lot of material, and it can be hard to keep up. But **all of you can succeed in this class!** For many of you, that will entail putting in more work than perhaps you're used to in science classes. But get used to that now! College STEM courses aren't easy, and they aren't meant to be! Normalize doing hard work. Normalize *struggling*, and succeeding anyway. Science (and Engineering) is all about getting things wrong and then improving your methods to get better results. There are all sorts of resources on campus to help you succeed, but none of them are more important than your classmates. The sooner you make connections to each other, the sooner it will pay off. Lastly, this class has a generous safety net! If you do the homework, come to class, come to recitation, and actively work to learn from your mistakes, you'll be in pretty good shape.

Instructor:

Professor Timothy Dransfield

Office: EXP 370B

E-mail: t.dransfield@northeastern.edu

Office hours: TBD, and by appointment

Lecture times:

CRN	Time	Days	Room	Top Hat 6-digit join code
11466	10:30 – 11:35	M, W, Th	130 Hurtig Hall	596070

Course Description:

Chem 1151 corresponds to one semester of study in important areas of modern chemistry, including details of the gaseous, liquid, and solid states of matter; intra- and intermolecular forces; and phase diagrams. It presents the energetics and spontaneity of chemical reactions in the context of chemical thermodynamics, while their extent and speed is discussed through topics in chemical equilibria and kinetics. Aspects of electrochemical energy storage and work are considered in relation to batteries, fuel, and electrolytic cells.

Overview of the Course:

Engineering is the application of science to practical problem-solving through the design and implementation of technological processes that improve our lives. All designs and processes involve materials at some level, so engineers should have an understanding of materials, especially of how their physical and chemical properties are related to their atomic and molecular structure. In CHEM 1151 we will explore these relationships. We will also examine the flow of energy that accompanies chemical transformations, particularly those that involve the combustion or electrolytic consumption of fuels.

You are expected to already have some knowledge of the basic principles of chemistry that are described in the first chapter of the text. **If you have never covered these topics or have trouble with them, please seek additional help. We want to be sure that you start out well. Consider completing the Ramp Up Chemistry course. See also the section of the syllabus on Resources for Success.**

Learning Goals:

By the end of this course you should be able to:

1. Use atomic structure and quantization of energy at the atomic level to explain the chemical properties of the elements.
2. Describe the composition of matter on atomic and molecular scales in terms of chemical formulae and structures.
3. Understand the nature and types of chemical bonding and its consequences for molecular shape and polarity and for electronic materials.
4. Predict key physical properties of pure gases, liquids, and solids and their mixtures and relate the physical properties of gases, liquids and solids to molecular shape and interactions between constituent atoms, ions and molecules.
5. Identify the products of chemical reactions and relate the quantities of reactants consumed and products created using balanced chemical equations.
6. Describe the energy changes that occur in chemical reactions in terms of the thermodynamic properties of reactants and products and use these changes to predict reaction spontaneity.
7. Apply, compare, and contrast kinetic and equilibrium descriptions for chemical reactions.
8. Identify the chemical reactions occurring in batteries and fuel cells and link the reactions to the power generated by these systems.
9. Appreciate the importance and relevance of chemistry in engineering and our global society

Mapping to ABET Student Outcomes:

Students successfully completing CHEM 1151 will have achieved the following measurable ABET Student Outcomes (SO):

- An ability to identify, formulate, and solve problems in chemistry (SO e);
- A proficiency in applying chemical principles to problems of interest to engineers (SO a);
- An ability to use the techniques, skills, and modern tools necessary for chemistry as relevant for engineers (SO k);
- An ability to analyze and interpret chemical data (SO b);
- An ability to apply chemistry to design features of a process or system that meet societal needs (SO c);
- An understanding of impact of technical solutions in global and societal contexts (SO h);
- A recognition of the need for and the ability to engage in lifelong learning by developing a more accurate and richer self-appraisal of themselves as learners (SO i).

Class Components

Canvas:

Canvas is an on-line course management system that supports all courses at Northeastern University. It is web-based and is designed to provide a convenient method for posting announcements, assignments, etc. You will have access to the Canvas sites for all courses you are enrolled in through your myNEU account and they can be accessed via the Canvas link on your MyNortheastern account, found on the "Services and Links" tab, or via <https://canvas.northeastern.edu>. It is **your responsibility to check this site regularly** for announcements, course handouts, YouTube videos, and the PowerPoint slides used in class.

Textbook:

Digital edition of *Chemistry: An Atoms Focused Approach (4th ed.)* (2025) ISBN: 97813247888, Gilbert, Kirss and Foster, WW Norton. Available in the bookstore or directly from the publisher.

Paid access to Achieve Essential On-line Homework System:

1. Find the Achieve content section of the course Canvas page.
2. Click on any Achieve assignment link to launch the assignment.
3. Select your access option and continue to your assignment page.
4. You are now enrolled in the course and can access future assignments through the links the Canvas page.
5. Technical support can be reached at **800-936-6899** or 24/7 through [Macmillan's chat/email form](#).

Paid subscription to Top Hat:

Top Hat is a classroom response system allowing you to participate in class through

- text messaging with your cell phone,
- an app on your smart phone or tablet or
- a web browser on your wifi-capable device (e.g. laptop)

To set up your Top Hat account,

- go to www.tophat.com ,
- click on “Student Sign Up,” and
- follow the directions.

You must set up your Top Hat subscription for the **lecture** section in which you are registered; the six-digit join code for the section appears with the lecture times at the beginning of this syllabus. When you register, please use your first and last name as the Registrar has it, your official Northeastern e-mail address, and your NU ID. This will allow me to identify correctly your specific Top Hat records. Online help for setting up your account and using Top Hat is available at [Student Overview and Getting Started Guide](#).

Scientific calculator (e.g., a TI-83, TI-84 Plus, equivalent or better.)

Please bring your calculator with you to lectures, recitations, and exams. You will **not** be allowed to use your cell phone during exams, so you should get used to using the calculator as soon as possible.

Classroom Recordings

This course, or parts of this course, may be recorded for educational purposes. These recordings will be made available only to students enrolled in the course, the instructor of record, and any teaching assistants assigned to the course.

Course Structure:

You are responsible for all material covered in lecture and all announcements made in lecture even if you are absent. If you miss all or part of any class, find out from a classmate what you missed. Most announcements will be posted on the Canvas site. Powerpoints used in lecture will also be posted on Canvas.

Lecture Participation Using Top Hat

During lectures, students will be given opportunities to assess their understanding of key concepts and mastery of important skills by using Top Hat. **These assessments are conducted live.** *You are encouraged to collaborate with other students before submitting your final answer to TopHat.* If you use a web browser and find you have issues with wireless connectivity, switch to the iOS or Android app and use offline mode, which stores your answers and sends them when you are reconnected. If you have any technical problems using this system, click the question mark (?) in the upper right hand corner of

your Top Hat screen, email support@tophat.com, or visit <http://support.tophat.com> to access the support forum. I cannot provide technical support for TopHat.

Students submitting any response to a question will receive 1 point towards their participation scores. Students submitting a correct answer - for questions that have a correct answer – will receive 1 point towards their correctness scores. Your participation and correctness scores, along with individual questions posed in class and the answers you submitted, can be viewed in your gradebook on Top Hat (not on Canvas). ***You must be present in the classroom when answering Top Hat questions. Answering a Top Hat question from outside of the class is a violation of the course's academic integrity policy.***

Homework Assignments

The old adage “practice makes perfect” is true. Success in chemistry requires, among other things, the development of critical thinking skills and problem-solving skills and the best way to develop these skills is by practice. Learning, achievement and success come with sustained and deliberate practice (as they do in most endeavors).

During the semester you will be required to complete homework assignments available to you through the Achieve system. A schedule for homework assignments is provided on page 11, with specific due dates for individual assignments. Questions in these assignments have been selected to reinforce key concepts and skills for specific topics. For each question, hints are available and you are allowed multiple tries before submitting a final answer. Feedback is provided in real-time after each try to help you work through incorrect answers. Take these assignments seriously, as they may form the basis for questions on exams. Solutions will be available after submission.

We encourage you to work with friends when doing homework. Working in study groups can be a very useful strategy for success. You may use your textbook, notes, Google, etc., when working on the assignments. Homework will be due at 11:00 pm on Fridays.

Recitations (CHEM 1153)

As noted above, CHEM 1151 has a co-requisite course called a recitation. You need to enroll in one of the recitation sections linked to your lecture. **It must be one of those listed below.** Recitations have a separate course number, CHEM 1153, and a separate CRN.

CHEM 1153 (Recitations for CHEM 1151)

CRN	Day & Time	Room	TA
10158	Monday 11:45	Hastings 211	Willis Bilderback
10508	Tuesday 3:25	Ryder 296	Willis Bilderback

We consider the recitation to be an integral part of the course and expect you to attend it weekly. It is in recitations that more difficult concepts and skills introduced in lectures and the reading will be

practiced. Recitations provide you with the opportunity to ask questions in a smaller group setting. Since homework assignments are due after your recitations, it can be particularly valuable to attempt the week's assignment before you go to recitation so you can go to recitation with questions.

During recitation, concepts and skills introduced in lecture and the reading will be reinforced by working on problems from the homework and/or worksheets with the help of your fellow classmates and TA. Your recitation grade will be based 50% on attendance and 50% on active participation in your small groups.

Exams

The three midterm exams and a comprehensive (cumulative) final exam will be closed book exams and will consist of both multiple-choice and open-response questions. The dates for the midterms appear in the course schedule at the end of this syllabus. Exams will assess both conceptual and quantitative understanding of material from lectures, recitations, and homework assignments. Because our focus is on your understanding and applying concepts and skills rather than on memorization, for each exam you will be provided with a *Useful Information Package* that will include relevant key definitions, constants, equations, tables and the like.

Requests for re-grades of exams must take place within one week of the exams being handed back. Simple grade addition errors will always be considered, but changes to partial credit assessments worth less than 3 points will not be considered.

The Final Exam for this course is a "Resurrection Final." It will consist of four sections. The first three sections will each correspond to material covered on the three midterm exams. If you score HIGHER on any given section of the Final than you did on the corresponding midterm, I will REPLACE your midterm grade with the score you earned on that section of the Final. It is possible, but unlikely, to replace all three midterms in this way.

Grading:

Course Component	Percentage of Grade
Top Hat question participation percentage	5%
Top Hat question correctness percentage	5%
Achieve homework assignments	15%
Recitation attendance	5%
Recitation active participation	5%
Three midterm exams – each contributing equally at 15%	45%
Final exam	20%

In addition, there will be some opportunities for minor extra credit throughout the semester. The first such opportunity is already available in the Welcome Module on Canvas.

I expect the Course Grading Scale to look like the table below. I reserve the right to be *more* generous than this, and I promise not to be *less* generous.

Letter Grade	Score
A- to A	$\geq 90\%$
B- to B+	80.0% - 89.9%
C- to C+	70.0% - 79.9%
D- to D+	60.0% - 69.9%
F	$< 60.0\%$
+/- grades	Instructor Discretion!

Remember that **there are no last minute grade fixes**. There will be no extra credit available except what is announced to the whole class. For this reason, it is wise to work conscientiously and diligently from the beginning of the semester.

Resources for Success:

There are a variety of resources that are available to you to help you succeed in this course. Please take advantage of all of them!

Your first source of help is in the weekly recitation section, which appears as CHEM 1153 on your course schedule. The CRN number for your section should be one of those listed in the table of page 6 of this syllabus. If it does not match, e-mail me.

You can see your recitation TA for help during their office hours. Your recitation instructor is the person who is primarily responsible for help on the assigned homework.

You can see me for help during my office hours. Some office hours will be held in person, and some will be conducted on Zoom. You can also set up an appointment with me. You may seek individual help or may come as a group.

The College of Engineering Tutoring Center provides peer tutoring for your freshman core classes on weekdays. Specific times for individual tutors for this course are posted on Canvas.

You can go to Chem Central (EXP 301) and get help from the person on duty at the time. Chem Central is a general resource provided by the Chemistry Department for students seeking extra help and is staffed by Chemistry faculty and teaching assistants. Chem Central is also a good place for you and friends to do homework together. It is typically open Monday – Friday from 10:00 am – 4:30 pm. A schedule will be posted to Canvas once the TA schedules are finalized during the first week of classes.

Northeastern University's Peer Tutoring Program (1 Meserve Hall) has a list of upperclassmen who did well in general chemistry who are available to assist you with one-on-one peer tutoring. To set up an appointment go to their website <http://www.northeastern.edu/csastutoring/>.

Expectations:

You are expected to:

- Prepare for each lecture by reading the assigned textbook sections and viewing any posted lecture notes, which will enable you to better participate in all in-class discussions and problem-solving sessions.
- Prepare for each recitation section by attempting the homework problems such that you can better discuss their solutions.
- Arrive for lecture and recitation on time so that your arrival doesn't cause a disruption.
- Submit all homework assignments on time.
- If you miss a class, discuss what you missed with a classmate; check the course's Canvas site for class notes and any announcements.
- Check the course's Canvas site regularly for announcements and other useful resources.
- Take responsibility for your learning:
 - Seek help when you need it
 - Organize in study groups if you find it useful
- Treat your instructors and other students in your class with respect. Cell phone and iPad rings should be turned off during class.
- Observe and abide by the rules of ethical behavior outlined in the Student Handbook and Northeastern's Academic Integrity Policy and the Honor Code of the College of Engineering.
- Respond in a timely fashion to all written and/or oral requests by the instructor and /or your TA and/or your academic advisor.
- Participate in the end-of-semester TRACE survey.

Special Accommodations:

If you believe you may require special accommodations for this course, including the taking of exams, contact Disability Access Services (DAS) (<https://disabilityaccessservices.sites.northeastern.edu/>). They can offer information and assistance to help manage any challenges that may affect your performance in coursework. Should you require an accommodation, you will be asked to bring or have DAS send paperwork to Professor Dransfield.

Unforeseen Circumstances:

The instructor reserves the right to make changes in the scheduling of all elements of the course, e.g. due dates for exams, homework assignments, etc., in response to any unforeseeable circumstance. If modifications are made, the instructor will communicate these modifications to the class via Canvas announcements.

Excused Absences and Make-Ups:

Absences will be excused only under appropriate circumstances (e.g., hospitalization, death of an immediate family member, or other unusual situation) and at the discretion of the instructor. Extensions of due dates for homework assignments and/or opportunities for make-up of recitations and/or exams missed in the event of hospitalization or other excused absences will be offered only at the discretion of the instructor. The instructor is the sole individual who can provide extensions of due dates for homework or any other assignments. Make up of any sort must be requested within one week of the absence. Students who misuse or abuse requests for excused absences or extension of due dates for homework will be subjected to the appropriate disciplinary action per university policies

University Academic Integrity Policy:

The University's academic integrity policy at Office of Student Conduct and Conflict Resolution (OSCCR) (<http://www.northeastern.edu/osccr/academic-integrity-policy>) discusses actions regarded as violations and their consequences for students.

Title IX:

The University strictly prohibits sex or gender discrimination in all university programs and activities. Information on how to report an incident of such discrimination (which includes sexual harassment and sexual assault) is located at <http://www.northeastern.edu/titleix>.

Inclusion and Diversity

I value all students regardless of their background, country of origin, race, religion, gender, sexual orientation, ethnicity, or disability status, and am committed to providing a climate of inclusiveness within all aspects of the course. If there are aspects of your culture or identity that you would like to share with me, I would be happy to discuss them with you. If you have any concerns in this area or are facing any special issues or challenges, I encourage you to discuss the matter with me as you feel comfortable, with my assurance of full confidentiality (the only exception being mandatory reporting of NU Academic Integrity Policy violations and Title IX sex and gender discrimination).

Equal Opportunity Policy:

Northeastern University is committed to providing equal opportunity to its students and employees, and to eliminating discrimination when it occurs. Northeastern University prohibits discrimination or harassment on the basis of race, color, religion, religious creed, genetic information, sex, gender identity, sexual orientation, age, national origin, ancestry, veteran or disability status. The policy can be found at: https://www.northeastern.edu/policies/pdfs/Policy_on_Equal_Opportunity.pdf.

WeCare

[WeCare](#) offers supports for students during times of difficulty or challenge. You can find WeCare at 226 Curry Student center Monday - Friday from 8:30-5:00, call at 617-373-7591, or email wecare@northeastern.edu.

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact We Care (<https://studentlife.northeastern.edu/we-care/>) for support. Furthermore, please notify the professor if you are comfortable in doing so. This will enable him to provide any resources that he may possess.

Mental Health Resources

In addition to mental health resources available through [Northeastern's University Health and Counseling Services](#) Northeastern has added [Find@Northeastern](#), which is a 24/7 mental health consulting line and can be reached at 1-877-223-9477.

Homework Assignment Schedule:

Homework Assignment	HW Assignment Due at 11:00 PM EST on...
HW 1	9/18
HW 2	9/25
HW 3	10/2
HW 4	10/9
HW 5	10/16
HW 6	10/23
HW 7	10/30 (sorry!)
HW 8	11/6
HW 9	11/13
HW 10	11/20
HW 11	12/4 (delayed due to Thanksgiving)
HW 12	12/11

Approximate Schedule:

The schedule is subject to changes; any changes will be announced in class and on Canvas.

Date	Lecture	Topic	Chapter Reading in Textbook
W 9/9	1	Matter and atomic theory	1.1, 2.1
Th 9/10	2	The periodic table; Atomic spectra	2.2-2.4, 3.1-3.2
M 9/14	3	Quantum nature of matter and light; wavefunctions	3.3-3.5
W 9/16	4	Quantum numbers; Orbitals	3.6-3.7
Th 9/17	5	Electron configurations; Periodic trends	3.10-3.12
M 9/21	6	Chemical bonding; Naming and classifying compounds	4.1 + 4.3
W 9/23	7	Lewis structures; Resonance	4.4-4.6
Th 9/24	8	Advanced Lewis Structures: Resonance, Electronegativity, Formal Charge	4.6-4.8
M 9/28	9	VSEPR; Polar molecules	5.1-5.3
W 9/30	10	Valence bond theory and hybrid orbitals; aromaticity	5.4-5.5
Th 10/1	11	Molecular orbital theory; Band theory; Semiconductors	5.7, 18.4-18.5
M 10/5	12	Intermolecular forces	6.1-6.3
W 10/7	13	Solubility; mixtures and solutions; Phase diagrams	6.3-6.6

Th 10/8	Midterm Exam 1 (covers through Th 10/1)		
M 10/12	Indigenous Peoples Day (no classes); Pre-recorded lecture for W 10/14 on Chapter 7.1 and 7.2		
W 10/14	14	Properties of solids; Structure of crystalline solids	18.1-18.2, 18.6-18.7
Th 10/15	15	Stoichiometric calculations; Limiting reagents and yield	7.3-7.4
M 10/19	16	Determining composition; Combustion analysis; Mass spectrometry	7.5-7.7
W 10/21	17	Dilution; Electrolytes; Acids and bases	8.2-8.5
Th 10/22	18	Precipitation; Solubility; Redox reactions	8.6-8.7
M 10/26	19	Colligative properties	11.3-11.6
W 10/28	20	Heat and work; Enthalpy	10.1-10.4
Th 10/29	21	Heat flow among objects and in phase changes; Calorimetry	10.4-10.6
M 11/2	22	Hess's law; Enthalpies of reaction	10.6-10.7
W 11/4	23	Spontaneity and entropy	12.1-12.4
Th 11/5	Midterm Exam 2 (covers through Th 10/29)		
M 11/9	24	Free energy; Temperature and spontaneity	12.4-12.8
W 11/11	Veterans Day (no classes); Possible pre-recorded lecture TBD		
Th 11/12	25	Rates of reaction and rate laws	13.1-13.3
M 11/16	26	Integrated rate laws; The Arrhenius equation	13.3-13.5
W 11/18	27	Reaction mechanisms; Catalysis	13.5-13.6
Th 11/19	28	Reversible reactions and equilibrium constants	14.1-14.4
M 11/23	29	The reaction quotient; Le Châtelier's principle	14.5-14.7
W 11/26	Thanksgiving Break (no classes)		
Th 11/27			
M 11/30	30	Calculations with K; Relating thermodynamics and chemical equilibrium	14.8-14.10
W 12/2	31	Calculating the pH of acidic and basic solutions	15.4-15.6
Th 12/3	Midterm Exam 3 (covers through M 11/17)		
M 12/7	32	Introduction to electrochemistry	17.1-17.5
W 12/9	33	Structure and properties of electrochemical systems	17.4, 17.6, 17.9
Th 12/10	34	Review or (more likely) catch-up	tbd
M 12/14	First Day of Final Exams		