

CHEM 2103 A Fall 2026

Physical Chemistry I

Course Instructor: Dr. Bob Burk

How to address me: Bob

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If you have a question or would like to talk with me, you can send an email, visit me during student hours (see below), or approach me after lecture.

Best Ways to be in Touch: in class, via email, or during student hours

Student Hours: TBA. See announcements on Brightspace

Office Location: Room 228 Steacie

Lecture Location: 236 TB

Lecture Times: Lectures Mondays and Wednesdays from 4:30 – 6:00 PM

Tutorial: Fridays 4:30 – 5:30 PM, also in 236 TB

Prerequisites: CHEM 1006 (no longer offered) with a minimum grade of B-, or [CHEM 1002](#) or [CHEM 1012](#), [MATH 1004](#), [MATH 1104](#) or [MATH 1107](#), ([PHYS 1001](#) and [PHYS 1002](#)) or ([PHYS 1007](#) and [PHYS 1008](#)) or ([PHYS 1003](#) and [PHYS 1004](#))

Department/Unit: Chemistry

Course TAs: See the lab section on the course Brightspace site

Topics Covered and Learning Outcomes

Topics to be Covered

Detailed list of topics to be covered, *including dates and required reading for each week.*

Week (approximate)	Topic/Content	Readings/Prep for Class (Chapters/Sections are in Physical Chemistry: Thermodynamics, Statistical Thermodynamics, and Kinetics" 4 th edition by Engel and Reid)
1	Fundamental Concepts	What is thermodynamics? (1.1) Basic definitions (1.2) Thermometry (1.3) Ideal gas law (1.4)
2-3	Kinetic Molecular Theory	Kinetic molecular theory (16.1) Velocity distributions in one dimension (16.2) Maxwell's distributions of molecular speeds (16.3) Average, most probable and mean speeds (16.4) Gas effusion (16.5) Molecular collisions (16.6) Mean free path (16.7)
3-4	Ideal and Real Gases	Real and ideal gases (1.5, 7.1) Equations of state, critical point, critical constants (7.2) Compression factor, Boyle temperature (7.3) Reduced variables and corresponding states (7.4) Fugacity (7.5)
5-6	First Law of Thermodynamics	Fundamentals of internal energy, heat, work (2.1-2.3) Doing work on the system and changing the system energy from a molecular perspective (2.4) Heat capacity (2.5) State and path functions (2.6) Equilibrium, Change and Reversibility (2.7) Reversible and irreversible work (2.8) Internal energy and enthalpy (2.9) q, w, ΔH and ΔU for ideal processes (2.10) Adiabatic processes (2.11)
6-7	State Functions U and H	Basic mathematical relationships (3.1) U (V,T), internal pressure (3.2, 3.3) H(T, const p) (3.4) C _p and C _v (3.5)

		H (p, const T) (3.6) Joule Thompson experiment and coefficient (3.7) Isenthalpic expansion (3.8)
8	Thermochemistry	Generalities (4.1, 4.2) Hess' law (4.3) Kirchoff's law (4.4) Experimental thermochemistry (4.5)
9-10	Second and Third Laws of Thermodynamics	Entropy and entropy changes, second law of thermodynamics (5.1 - 5.7) Absolute entropies and the third law of thermodynamics (5.8 - 5.14)
11-12	Chemical Equilibrium	Gibbs (G) and Helmholtz (A) energies (6.1) Differential forms of U, H, A and G (6.2) Other aspects of chemical equilibrium (6.3 - 6.13)

Important dates and deadlines can be found here:

<https://calendar.carleton.ca/academicyear/>, including class suspension for fall, winter breaks, and statutory holidays.

Assessments

Grade Breakdown

COMPONENT	GRADE VALUE	DATE
ONLINE QUIZZES VIA MASTERING CHEMISTRY	10 %	Eight assignments in total, one per chapter covered. Requires access to Mastering Chemistry, which comes with your book purchase.
WRITTEN ASSIGNMENTS	10%	Four Assignments in total, spread out over the term.
MIDTERM TEST	20 %	During class time on Thursday October 14, 2026.
FINAL EXAM	30 %	December 2026.

LAB	30 %	The lab portion must be completed to pass the course!
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The lab portion of the course must be complete in order to receive a passing grade. None of the assignments, exams or lab are optional, and the marking scheme is the same for everyone.

The final exam will not be weighted more to make up for a poor mark on a test or assignment.

Late and Missed Work Policies

Late Work

The online quizzes each will have a deadline, typically the evening before the next chapter's lectures begin. Each quiz will be available well in advance, so the deadline is hard and fast, and will not be extended. Late assignments will incur a penalty of 10% per day.

Missed Work

If you miss a lab, contact the lab coordinator to arrange for a makeup time. If you miss multiple labs, it may not be possible to arrange makeups for all of them, so remember that all labs must be complete to pass the course. Submit the [academic considerations form](#) for any missed work, including the midterm test or labs.

If you miss work for longer than 5 days, consult the [longer-term accommodation](#) policy.

Learning Material(s) and Other Course/Lab-Related Resources

Learning Material	How to Purchase	Cost
Course textbook is "Physical Chemistry" by Engel and Reid (4th edition), published by Pearson Education. Includes e-book and Mastering Chemistry access, which you need in order to do the online quizzes. Also used in CHEM 2104.	Bookstore	\$107.50
Lab Notebook		

Lab Coat		
Lab Glasses		

Having a paper copy of the textbook (used or new) is fine, but you would still need to purchase access to the online system (“Mastering Chemistry”).

Academic Accommodations and Regulations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances, are outlined on the Academic Accommodations website (<https://students.carleton.ca/course-outline/>).

Statement on Generative Artificial Intelligence (GenAI) Usage (See the [Sample Syllabus Statements for AI use in Courses](#) document for examples)

As our understanding of the uses of GenAI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of GenAI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course. GenAI can answer just about any question in an intro chemistry course like CHEM 1001 or 1002. For this reason, 80% of your grade will come from in-person assessments such as the midterm test and final exam, as well as the lab component. The remaining 20% comes from the online quizzes which you complete on your own. You may be thinking “great, an easy 20% with the help of GenAI...” But the simple fact is that if you put little thought into these quizzes, you will fail the midterm test, the final exam, and likely the course itself. Use your own brain, and you will learn the material and do well in the course.

If you use GenAI to help guide you when writing a lab report, you must document this, clearly indicating what is not your original thought. GenAI is getting better at appearing to be human, but we are getting better at detecting what is not. Don’t take the chance – do your own thinking.

Statement on Academic Integrity

Students are expected to uphold the values of academic integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests, unauthorized collaboration on assignments or exams, and using Generative Artificial Intelligence (GenAI) tools when course assessment instructions indicate such use is not permitted.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in [Carleton University’s Academic Integrity Policy](#). A list of standard sanctions in the Faculty of Science can be found [here](#).

Additional details about this process can be found on [the Faculty of Science Academic Integrity website](#).

Students are expected to familiarize themselves with and abide by [Carleton University’s Academic Integrity Policy](#).

Student Rights & Responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the [7 Rights and Responsibilities Policy](#) for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.

Student Concerns

If a concern arises regarding this course, **your first point of contact is me**: Email or drop in during student hours and I will do my best to address your concern. If I am unable to address your concern, the next points of contact are (in this order):

Note: You can also bring your concerns to [Ombuds services](#).

