CHEM 1002 A and B for Winter 2026
General Chemistry II

We, the people of the Faculty of Science at Carleton University, acknowledge that our campus is located on the traditional, unceded territories of the Algonquin Anishinabeg people. Miigwetch for your hospitality and stewardship of this territory and the teachings that come from it. We are grateful for this land, the air that we breathe, and the water that sustains us all as well as for the animals, plants and other living beings: these enable us to
research, teach, mentor, support, study, and learn. We recognize our responsibility to our natural environment and to reconciliation with Indigenous peoples.

All dates and times referenced in this course pertain to local time at Carleton University. This corresponds to Eastern Standard Time (EST) with Daylight Savings Time applied on the appropriate dates.

Course Instructor Section A: David Brock

How to address me: Anything respectful (ex. Dave, Doc Brock, Dr. Brock, etc.)

Email: David.Brock3@Carleton.ca

Best Ways to be in Touch: see page 7
(in class, via email, or during student hours)

Student Hours: Tues and Thurs, 1:00-2:00pm, SC 226

Office Hours Location: Room 226, SC Building

Course Instructor Section B: Daniel Gregoire

How to address me: Anything respectful (ex. Daniel, Dr. or Prof. Grégoire, etc.)

Email: DanielGregoire@cunet.carleton.ca

Student Hours: Wed and Fri, 1:00 – 2:00 PM SC 419

Office Location: Room 419, SC Building

Class Location: Please check Carleton Central for the room location.

Class Times: 11:30-1:00
Tuesday(s)&Thursdays (section A),

Wednesday(s)&Fridays (section B)

Prerequisites: CHEM 1001

Preclusions: CHEM 1006 (no longer offered),
CHEM 1012

Department/Unit: Chemistry

Lab Coordinators:
Mastaneh Azad
mastaneh.azad@carleton.ca

Natalie Mesnic
Natalie.mesnic@carleton.ca

Learning Outcomes and Topics Covered

Course Description

Topics include thermodynamics and spontaneity, kinetics, electrochemistry, organic chemistry, transition metal complexes, and green chemistry. Examples relate to health, energy, materials, and the environment.
Includes: Experiential Learning Activity

The course has an emphasis on the development of skills such as critical thinking, problem solving, analysis, and quantitative reasoning; these “transferrable skills” are essential to success in not just chemistry but also in other courses and many occupations. Any student receiving credit for Chem 1002 will be expected to demonstrate competence in his or her ability to:

Discipline-Specific Outcomes	Transferrable-Skill Outcomes
Describe the importance of chemistry in everyday life and the interdisciplinary nature of chemistry.	Analyze and critically assess problems, and take a systematic approach to solve them.
Use critical thinking skills to explain, make connections between and apply chemical principles, laws, and theories pertaining to thermodynamics, chemical kinetics, electrochemistry, organic chemistry and transition metal complexes.	Obtain, evaluate, and integrate information from various sources, and determine its relevance.
Evaluate and assess chemical data and explain how they relate to chemical theories/laws.	Work with others in an effective, practical, social, and ethical manner.
Apply chemical theories or laws to solve a variety of new qualitative and quantitative chemical problems.	Prioritize a set of tasks and manage the use of his or her time.
Conduct laboratory experiments and draw conclusions from collected experimental data and results.	Execute mathematical calculations accurately.
Safely use a variety of laboratory equipment and instrumentation to perform experimental procedures and explain the underlying theory behind all of them.	Communicate thoughts, ideas, and observations verbally and in writing.
	Recognize when to seek assistance.
	Develop respect for, and comply with, regulations and policies.
	Accept responsibility for his or her decisions, actions, and non-actions.

Topics to be Covered

A detailed list of topics to be covered, and important dates can be found on pages 8-10 of this syllabus and in the calendar found on the last page

Additional important dates and deadlines can be found here: https://carleton.ca/registrar/registration/dates/academic-dates/, including class suspension for fall, winter breaks, and statutory holidays.

Textbook

The text for the course is "Chemistry" 4th Canadian Edition by Olmsted, Williams and Burk published by Wiley. The book is available from Carleton's bookstore ($60+tax), however, permanent electronic access is also available through the instructions listed on the course Brightspace page at a discounted price ($60+tax).

The latter is the recommended package to buy.

Assessments

Grade Breakdown

Component	Notes	#1	#2	#3	#4	#5	#6	#7	#8
Mastering	6 Online Homework Assignments	5	--	5	--	5	--	5	--
Quizzes	Weekly Online Quizzes	10	10	10	10	10	10	10	10
Laboratory	Four experiments	30	30	30	30	30	30	30	30
Test 1	2 h	12.5	12.5	6.25	6.25	12.5	12.5	6.25	6.25
Test 2	2 h	12.5	12.5	18.75	18.75	6.25	6.25	6.25	6.25
Final Exam	3 hours	30	35	30	35	36.25	41.25	42.5	47.5

Grades for each component of the course will be released only via Brightspace.

To obtain credit for the course, all three requirements below must be met:

1. Obtain a minimum of 50% on the overall course grade, as calculated above using the method that gives the highest grade.
2. All laboratory experiments MUST be completed and all lab reports MUST be submitted by the last day of classes (Apr 8, 2026).

Students who fail to meet the above requirements will receive a course grade of F and will not receive credit for the course.

Mastering Chemistry Online Homework Assignments

The optional (see Grading schemes above) homework system, Mastering Chemistry, can be purchased from Carleton's bookstore ($64.50+tax), or at a discounted price ($60+tax) directly from the publisher using the instructions posted on the course Brightspace page. Problem assignments will be given regularly via Mastering Chemistry (approximately one assignment every two weeks). It is your responsibility to check the answers and to take action if you have not understood the latest material. **Those who neglect these assignments do not typically do well on tests and exams, where the stakes are much higher. Evidence from previous years shows that those who scored well on their homework assignments typically also scored well in the course.**

Quizzes

There will be 12 timed quizzes (60 minutes per quiz), but only the best 10 will be used to calculate your mark on the Brightspace Quiz component of the course. If you receive academic accommodations for a missed quiz, the remaining 10 quizzes will be counted.

Access to these timed quizzes starts on Sunday at 12:01 am and closes on Monday at 11:55 pm. Quizzes are 1 hour in length and therefore must be started by the Monday at 10:55pm at the latest. Quizzes will begin on Jan 11th and continue weekly for the rest of the term, with the exception of Fall Break (week of Feb 16th). Please see the course calendar for more details.

Laboratory

Details of the laboratory portions of this course can be found on the Brightspace site. Students are required to wear protective goggles ($4.49), a lab coat ($24.60) and use a lab notebook ($7.22) which can all be purchased from Science Stores (https://payments.carleton.ca/science/science-stores/)

An important detail is that you must complete all activities of the laboratory portion before the last day of classes (Apr 8, 2026) to receive a passing grade in this course.

Term Tests

The term tests will be scheduled by the Registrar's office and will take place on campus, outside of class time the weeks of Feb. 3 and Mar. 17 (which can include and will most likely take place on Friday evening, Saturday or Sunday).

Final Exam

The Final Exam will be scheduled by the Registrar's office and will take place on campus,
between Apr. 11 and Apr. 23 (which can include Friday evening, Saturday or Sunday).

Late and Missed Work Policies
Late Work

Students have *one to two weeks* (see the lab schedule for due dates) to complete and submit their lab reports for each lab, and multiple submissions are permitted up until the due date. As a result, lab reports that are submitted late for any reason will be subject to the late penalty of 10% per day, with a mark of 0 assigned if an assignment is submitted more than 4 days late. Therefore, you are encouraged to submit your lab report a day or two early, and update it if necessary, to ensure that you have no issues with your lab submission.

Missed Work

For short term (a week or less) incapacitation, students must complete and submit the Academic Consideration for Coursework Form - Registrar's Office (https://carleton.ca/registrar/academic-consideration-coursework-form/) within 48 hours of the missed work. For approved missed tests, the weight will be transferred to the final exam. For missed quizzes, the top 10 of 12 quizzes are used to calculate the final mark and the missed quiz would be 1 of the 2 quizzes not counted. Assignments are open for two week periods whereupon the answers are released. In the event that a due date is missed, the work on the assignment up to that point is used for that assignment grade and extensions are not provided. Students are encouraged to start the assignments early. There is a single makeup lab opportunity available to students in the event that they have received a lab deferral. Therefore, missing more than one lab, deferred or not, will result in an F in the course as the course/department requirement that "All laboratory experiments MUST be completed and all lab reports MUST be submitted by the last day of classes (Apr 8, 2026)" would not be fulfilled.

Long term (longer than 1 week) incapacitation, will be evaluated on a case-by-case basis and discussions of accommodations may involve the Chair of the Department of Chemistry and/or the Office of the Dean of Science.

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 are outlined on the Academic Accommodations website (https://students.carleton.ca/course-outline/).

AI Use in This Course

Students may use AI tools for basic word processing and formatting functions, including:

- Grammar and spell checking (e.g., Grammarly, Microsoft Word Editor)
- Basic formatting and design suggestions (e.g., Microsoft Word's formatting tools, PowerPoint Design editor)

Documenting AI Use: It is not necessary to document the use of AI for the permitted purposes listed above. If you have questions about a specific use of AI that isn't listed above, please consult your instructor.

Academic Integrity

The University Senate defines plagiarism as "presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own." This can include:

- reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source;
- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, or paraphrased material, concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another's data or research findings;
- failing to acknowledge sources through the use of proper citations when using another's works and/or failing to use quotation marks;
- handing in "substantially the same piece of work for academic credit more than once without prior written permission of the course instructor in which the submission occurs.

Plagiarism is a serious offence that cannot be resolved directly by the course's instructor. The Associate Dean of the Faculty conducts a rigorous investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of "F" for the course.

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.

Mental Health and Wellness:

As a student you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. If you need help, please speak to someone. There are numerous resources available both on- and off-campus to support you. For more information, please consult https://wellness.carleton.ca/.

Communicating With You

This is a big class, but you will find that you can get any help you need easily by one of the following methods:

1. If it is a course content related question, please post it to the Brightspace forum or bring it to the Chemistry Help Center. Chances are if you have the question, your colleagues do as well and could benefit from the answer.
2. Visit an instructor in their office hour. David Brock's office hours will be held on Tuesdays and Thursdays from 1:00-2:00 PM. Daniel Grégoire's office hours will be held on Wednesdays and Fridays from 1:00-2:00 PM in SC 419.
3. Attend the drop-in Chemistry Help Center. Hours will be posted on Brightspace at the beginning of term and additional hours may be posted as well.
4. If it is an administration/accommodation related issue, email me directly (david.brock3@carleton.ca). Please note, if it is a course content related question, it will be redirected to the Brightspace forum, office hours or Brightspace.
5. Your TAs, fellow students and other people on campus are also great resources and form a great study tool.

Syllabus

3. Energy and Its Conversion

Types of Energy
Kinetic and Potential Energies
Electrical Energy
Chemical Energy
Mass
Thermal Energy
Radiant Energy
Energy Transfers and Transformations
Thermodynamics
Terms of Thermodynamics
Conservation of Energy
Heat
Work
First Law of Thermodynamics
State and Path Functions
Thermodynamic Path Functions
Energy Changes in Chemical Reactions
Features of Reaction Energies
Path Independence
Bond Energies
Reaction Energies
Measuring Energy Changes: Calorimetry
Calorimeters
Types of Calorimeters
Calculating Energy Changes
Molar Energy Change
Enthalpy
Expansion Work
Definition of Enthalpy
Energy and Enthalpy
Energy and Enthalpy of Vapourization
Enthalpies of Formation
Enthalpy Changes for Chemical Reactions
Enthalpy Changes Under Non-Standard Conditions
Bond Energies and Enthalpies of Formation
Born-Fajans-Haber Cycles
Relationship Between Enthalpy and the Equilibrium Constant

12. Spontaneity of Chemical Processes

Spontaneity
Dispersal of Matter
Energy Dispersal
Energy and Spontaneity
Opposing Dispersal Trends
Entropy: The Measure of Dispersal
Entropy and Dispersal of Matter
Entropy and Dispersal of Energy
Direction of Heat Flow
Entropies of Pure Substances
Minimization of Entropy
Absolute Entropies
Entropy and Concentration
Standard Reaction Entropies
Spontaneity and Free Energy
Free Energy and Temperature
Free Energy and Concentration
Influencing Spontaneity
Bioenergetics
Biochemical Energy Production
Coupled Reactions
Energy Efficiency

13. Kinetics: Mechanisms and Rates of Reactions

What is a Reaction Mechanism?
Example of a Mechanism: Formation of N_2O_4
Elementary Reactions
Alternative Mechanisms
Intermediates
Rate-Determining Step
Rates of Chemical Reactions
A Molecular View
A Macroscopic View: Concentration Changes
Concentration and Reaction Rates
Concentration Effects
Rate Laws
Mechanisms and Rate Laws
Rate Constants
Experimental Kinetics
First-Order Reactions
Second-Order Reactions
Zeroth-Order Reactions
Isolated Experiments
Initial Rates
Linking Mechanisms and Rate Laws
Rate-Determining Later Step
Equality of Rates
Rate of Reaction and the Equilibrium Constant
Reaction Rates and Temperature
Energy Changes in Unimolecular Reaction
Energy Changes in Bimolecular Reactions
Activation Energy

Activation Energy and Rate Constant
The Arrhenius Equation
Values of Activation Energy
Kinetics of S_N1 and S_N2 Reactions
Catalysis
Homogeneous and Heterogeneous Catalysts
Biocatalysis: Enzymes

17. Electron Transfer Reactions

Recognizing Redox Reactions
Oxidation Numbers
Balancing Redox Reactions
Half-Reactions
Galvanic Cells
Direct and Indirect Electron Transfers
Ion Transport
Electrodes
Shorthand Cell Notations
Cell Potentials
Standard Electrical Potential
Standard Cell Voltages
Conventions for Standard Reduction Potentials
Free Energy and Electrochemistry
Cell Potential and Free Energy
Cell Potentials and Chemical Equilibrium
Nernst Equation
The pH Meter
Electrochemical Stoichiometry
Redox in Action
Batteries
Corrosion
Electrolysis
Electrolysis of Water
Competitive Electrolysis
Electroplating

10. Organic Chemistry – Structure

Nomenclature
Hydrocarbons
Naming Benzene Compounds
Kekulé Structures
Functional Groups
Stereochmistry
E/*Z*; *cis*/*trans*
Conformers
Newman Projections
Simple Potential Energy Diagrams
Boat and Chair Conformations
Enantiomers and Diastereomers
Chirality
R and *S*

11. Organic Chemistry – Reactions

Nucleophiles and Electrophiles
S_N1 and S_N2 Mechanisms and Products
E1 and E2 Mechanisms and Products
Addition Reactions and Mechanisms
Hydrogenation of Alkenes
Markovnikov's Rule
Acid-Catalyzed Hydration
Electrophilic Addition of Br_2 and Cl_2 to Alkenes

19. The Transition Metals

Overview of the Transition Metals
Coordination Complexes
Ligands
Isomers
Nomenclature
Bonding in Coordination Complexes
Orbital Stability in Octahedral Complexes
Magnetic Properties
Crystal Field Splitting
Colour in Coordination Complexes
Square Planar and Tetrahedral Complexes

	Monday	Tuesday	Wednesday	Thursday	Friday
	January				
Intro Ch 3	**5** Classes Begin	**6**	**7**	**8**	**9**
Ch 3	**12** *Quiz 1 Due 11:55 pm*	**13**	**14**	**15**	**16** *Last day for add/swap*
Ch 12	**19** *Quiz 2 Due 11:55 pm*	**20**	**21**	**22** *Mastering Chem. Assignment #1 Due 11:55 pm*	**23**
Ch 13	**26** *Quiz 3 Due 11:55 pm*	**27**	**28**	**29**	**30** *Last day for withdrawal with full fee adjustment*
	February				
Ch 13 and Review	**2** *Quiz 4 Due 11:55 pm*	**3**	**4**	**5** *Mastering Chem. Assignment #2 due 11:55 pm*	**6** **Test this week (date/time TBA)**
Ch 17	**9** *Quiz 5 Due 11:55 pm*	**10**	**11**	**12**	**13**
No Labs or Classes	**16** **Spring Break** *Holiday (University Closed)*	**17** **Spring Break**	**18** **Spring Break**	**19** **Spring Break**	**20** **Spring Break**
Ch 10	**23** *Quiz 6 Due 11:55 pm*	**24**	**25**	**26** *Mastering Chem. Assignment #3 due 11:55 pm*	**27**
	March				
Ch 10	**2** *Quiz 7 Due 11:55 pm*	**3**	**4**	**5**	**6**
Ch 11	**9** *Quiz 8 Due 11:55 pm*	**10**	**11**	**12** *Mastering Chem. Assignment #4 due 11:55 pm*	**13**
Review	**16** *Quiz 9 Due 11:55 pm*	**17**	**18**	**19**	**20** **Test this week (date/time TBA)**
Ch 11	**23** *Quiz 10 Due 11:55 pm*	**24**	**25**	**26** *Mastering Chem. Assignment #5 due 11:55 pm*	**27**
	April				
Ch 19	**30** *Quiz 11 Due 11:55 pm*	**31**	**1**	**2**	**3** **Holiday**
Review	**6** *Quiz 12 Due 11:55 pm*	**7**	**8** *Mastering Chem. Assignment #6 due 11:55 pm* Classes End	**10**	**11**