CHEM 1002 A for Summer 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: Saud Ayed

How to address me: By my first name, Saud

Email: saudayed@cunet.carleton.ca

Do *NOT* use saudayed@cmail.carleton.ca

(I don't monitor this email address regularly)

Student Hours: By appointment

Office Hours Location: Virtual (Zoom)

Email policy - Please allow 48h for a response to emails. Emails will not get a response after 8:00 PM on Monday to Friday, and on weekends.

Send all email correspondence through a Carleton email address ONLY

Class Location: Please check Carleton Central for the room location

Class Times: Mondays & Wednesdays at 11:30-2:30 pm

Tutorial location: Please check Carleton Central for the room location

Tutorial times: Fridays at 10:00 am -12:00 pm

Prerequisites: CHEM 1001

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

Department/Unit: Chemistry

Lab Coordinators:
Graham Galway
grahamgalway@cunet.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

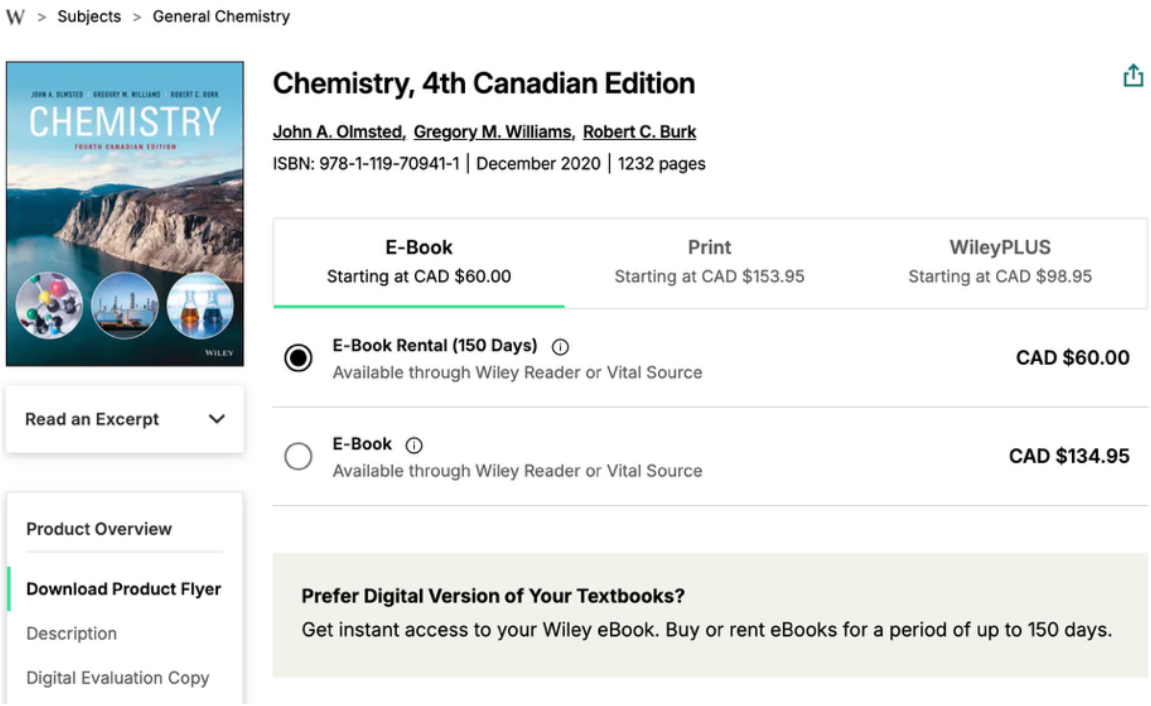
A detailed list of topics to be covered, and important dates can be found on pages 10-12 of this syllabus and in the calendar found on the last page

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 recommended textbook for the course is "Chemistry" 4th Canadian Edition by Olmsted, Williams and Burk published by Wiley. The recommended textbook can be purchased via Carleton bookstore or directly from the publisher's website. Note there are many different options to choose from (single term, multi-terms, rental, etextbook, hardcopy and with WileyPLUS).

The recommended textbook comes with WileyPLUS assignments package with extra cost. Refer to the WileyPLUS section before for more details.



Assessments

Grade Breakdown

Component	Notes	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Laboratory	Four experiments	30	30	30	30	30	30	30	30	30	30	30	30
Tutorials	In-class	5	5	5	5	5	5	5	5	5	5	5	5
iClicker*	In-class participation	5	5	5	0	0	0	5	5	5	0	0	0
WileyPlus*	3 online assignments	10	10	10	10	10	10	0	0	0	0	0	0
Test 1	2 hours	10	0	10	10	0	10	10	0	10	10	0	10
Test 2	2 hours	10	10	0	10	10	0	10	10	0	10	10	0
Final exam	3 hours	30	40	40	35	45	45	40	50	50	45	55	55

iClicker in-class participation and WileyPlus assignment are **OPTIONAL, thus different marking schemes are adopted to accommodate.*

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.

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

It is your responsibility to be aware of deadlines, test dates, and course policy, so please read this syllabus carefully.

Laboratory

Details of the laboratory portions of this course can be found on the Brightspace site. Students are required to wear protective goggles ($6.29), a lab coat ($26.68) 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 to receive a passing grade in this course.

Tutorials:
This is a mandatory in-class activity that is scheduled on Fridays (see Time and Grading schemes). During the tutorials, you will be given a set of problems to practice. The main objective is to train you on how to tackle the problems. You need to document your attendance and submit your work by the end of each tutorial. There are 4 tutorials in total where the tutorial marks are distributed equally.

Optional iClicker Participation (in-class activities):
During the lectures, you will be given a set of practice questions. The main objective is to train you on how to tackle concept/calculation-based questions. You will be asked to submit your answer online using iClicker Cloud app.

iClicker Cloud App is $15.99, valid for 6 months, can be purchased directly from the provider by clicking here or copy/paste the url below or Carleton's bookstore. Note that this access code grands access to multiple courses (you don't need to purchase another access code for another course during this time).

https://www.iclicker.com/pricing

To create your iClicker Cloud account and join the course, click on the following url (this is a direct link to the course)

https://join.iclicker.com/CWRG

Or scan the following QR code

Your mark on the iClicker concept polls for the course will be determined as follows:

Points for responding to a concept poll in class:	2 points
Points for the correct response:	1 point
Total points per question asked	3 points

Percent of total points earned:	80 or over	75-79	70-74	60-69	50-59	40-49	30-39	20-29	Under 20
Mark out of 10:	10	9	8	7	6	5	4	3	0

Please note that the threshold was set low to account for occasional absences or technical difficulties. As a result, adjustment to data will only take place if an absence *exceeds* one week of class and is accompanied by official accommodation.

Please note, all students will be able to participate in this activity but ***ONLY*** students using iClicker Cloud App will get the credit for this activity, hence it is labeled ***optional*** on the assessment table above. Thus, this activity is ***recommended*** and ***not required***. Those who neglect these iClicker activities do not typically do well on tests and exams, where the stakes are much higher. Evidence from previous years from previous courses shows that those who participated and scored well on their iClicker typically also scored well in courses.

Note: if you cancel your subscription during the course, your iClicker grade will be calculated based on the total number of points during the entire course, not only during your period of subscription.

Optional WileyPLUS Online Homework Assignments

The optional (see Grading schemes above) homework system, WileyPLUS, can be purchased from Carleton's bookstore or directly from the publisher for $98.95 or in combination with etextbook for $163.95.

Three problem assignments will be given regularly via WileyPLUS (approximately one assignment every ~ two week, each assignment will be open for ~ two week and it is due at 11:59 pm) – consult the schedule below on last page for exact timing. 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.

Term Tests

The term tests will be scheduled by the Registrar's office and will take place on campus, during the tutorial times on July 17th and August 7th. The mid-terms are closed book, and format can be a mix of multiple choice, true/false, fill in blanks, short answers and long answers.

Final Exam

The Final Exam will be scheduled by the Registrar's office and will take place on campus at the end of the semester (which can include Friday evening, Saturday or Sunday). The final exam is cumulative (meaning that it will cover everything we learn during the course). The final exam format can be a mix of multiple choice, true/false, fill in blanks, short answers, and long answers. The final exam will be scheduled by the register's office.

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 tutorials, the weight will be transferred to the final exam.

For missed midterm tests, there will be **NO** make up tests or online test alternatives. Students are expected to write tests in-person on campus. Distance tests are not allowed, and only allowed to very special unique cases, refer to Distance Exam for more details. For missed midterm test, the weight will be transferred to the final exam, hence the different marking schemes.

Homework 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 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.

Deferred Final Exam

University policy allows for the deferral of exams for extenuating circumstances, such as illness or catastrophic events. To apply for a deferral, you must complete an online deferral application form. Applications must be received by the Registrar's Office within three business days of the missed exam.

To defer your final exam, do ***NOT*** email me, instead you need to follow the instructions provided in the following link.
https://carleton.ca/registrar/special-requests/deferral/

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 can use AI as a personal teaching assistant tool to help learn and understand the concepts. 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/.

Communications

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. Send me an email to set-up a meeting time.
3. Attend the drop-in 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 (saudayed@cunet.carleton.ca). Please note, if it is a course content related question, it will be redirected to arranged office hours.
5. Your TAs, fellow students and other people on campus are also great resources and form a great study tool.

IMPORTANT:

1. THERE WILL NOT BE ANY MAKE-UP/EXTRA ASSIGNMENT/WORK TO ARTIFICIALLY BOOST UP YOUR FINAL GRADE. ** do not even ask!!

2. I WILL NOT REWIEGHT EVLUATIONS (mid-terms and tutorials… etc) TO BOOST UP YOUR FINAL GRADE… This is why we have different marking schemes!

Syllabus

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

14. Principles of Chemical Equilibrium
Describing Chemical Equilibria
Dynamic Equilibrium
The Equilibrium Constant
Reversibility
Properties of Equilibrium Constants
Concentration Units and Activities
Pure Liquids, Pure Solids, and Solvents
Direction of a Reaction at Equilibrium
Magnitudes of Equilibrium Constants
Thermodynamics and Equilibrium
Free Energy and the Equilibrium Constant
Calculating Keq from $\Delta G°$
Equilibrium Constants and Temperature
Shifts in Equilibrium
Le Châtelier's Principle
Changes in Amounts of Reagents
Effect of Catalysts
Effect of Temperature
Working with Equilibria
Chemistry of Equilibria
Initial Conditions and Concentration Tables
Calculating Equilibrium Concentrations
Working with Small Equilibrium Constants
Working with Large Equilibrium Constants
Equilibria in Aqueous Solutions
Species in Solution
Types of Aqueous Equilibria
Identifying Types of Equilibria
Spectator Ions

15. Aqueous Acid–Base Equilibria
Proton Transfers in Water
Conjugate Acid–Base Pairs

Autohydrolysis of Water
Strong Acids
Strong Bases
The pH Scale
Weak Acids and Bases
Weak Acids: Proton Transfer to Water
Weak Bases: Proton Transfer from Water
Recognizing Acids and Bases
Oxoacids
Carboxylic Acids
Other Acids
Weak Bases
Acidic and Basic Salts
Salts of Weak Acids
Salts of Weak Bases
Summarizing Acids and Bases
Factors Affecting Acid Strength
Effect of Charge
Structural Factors
Multiple Equilibria
Polyprotic Acids
Salts of Polyprotic Acids

16. Applications of Aqueous Equilibria

Buffer Solutions
The Composition of Buffer Solutions
Molecular View of a Buffer Solution
The Buffer Equation
Buffer Action
Capacity and Preparation of Buffer Solutions
Buffer Capacity
Buffer Preparation
Acid–Base Titrations
Titration of a Weak Acid by OH- Ions
Titration of a Weak Base with H3O+ Ions
Titration of Polyprotic Acids
Indicators
Solubility Equilibria
Precipitation Equilibria
The Common-Ion Effect
Effects of pH

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

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

Monday	Tuesday	Wednesday	Thursday	Friday
July				
		1	**2** Classes Begin	**3**
6 *Intro + Chapter 12*	**7**	**8** *Chapter 12*	**9**	**10** *Tutorial*
13 *Chapter 13* *Assignment 1 due*	**14**	**15** *Chapter 13*	**16**	**17** **Test 1**
20 *Chapter 14*	**21**	**22** *Chapter 14 +15*	**23**	**24** *Tutorial*
27 *Chapter 15* *Assignment 2 due*	**28**	**29** *Chapter 16*	**30**	**31** *Tutorial*
August				
3 *No classes*	**4**	**5** *Chapter 16 + 17*	**6**	**7** **Test 2**
10 *Chapter 17* *Assignment 3 due*	**11**	**12** *Chapter 11*	**13**	**14** *Chapter 11 and/or Tutorial follows Monday schedule*

Note: this is the tentative schedule, timing/delays may vary as course proceeds. Any changes to lectures and/or assessment timing (e.g. assignment or test) will be announced in class and on Brightspace.