

General Chemistry 1 - CHEM 1001 A/B

Fall 2024

Department of Chemistry

Instructors:
Dave Brock
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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.

Lectures

Lectures are pre-recorded and can be played back at any time.
You must keep up to date in your lecture watching!

“Classes”

“Classes” are in-person on Tuesdays and Thursdays from 11:35am-12:55pm (according to your Timetable). You are encouraged to participate – These “classes” times will be used to work on problem solving skills, answer concept polls, show connections and applications of the content to the real world, perform chemical demonstrations as well as carrying out topic discussions.

“Tutorials”

“Tutorials” are drop-in in-person help center hours that take place during most laboratory time slots (according to your Timetable). You are encouraged to attend to ask questions about course content or any chemistry related questions you might have.

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, however, permanent electronic access is also available through the instructions listed on the course Brightspace page at a discounted price.

The latter is the recommended package to buy.

Grading

Component	Notes	#1	#2	#3	#4	#5	#6	#7	#8
Mastering	6 Online Homework Assignments	5	--	5	--	5	--	5	--
Reef Polling	Class concept polls	5	5	--	--	5	5	--	--
Quizzes	Weekly Online Quizzes	10	10	10	10	10	10	10	10
Laboratory	Four experiments	20	20	20	20	20	20	20	20
Test 1	2 h	12.5	12.5	12.5	12.5	6.25	6.25	6.25	6.25
Test 2	2 h	12.5	12.5	12.5	12.5	18.75	18.75	18.75	18.75
Final Exam	3 hours	35	40	40	45	35	40	40	45

Component	Notes	#9	#10	#11	#12	#13	#14	#15	#16
Mastering	6 Online Homework Assignments	5	--	5	--	5	--	5	--
Reef Polling	Class concept polls	5	5	--	--	5	5	--	--
Quizzes	Weekly Online Quizzes	10	10	10	10	10	10	10	10
Laboratory	Four experiments	20	20	20	20	20	20	20	20
Test 1	2 h	12.5	12.5	12.5	12.5	6.25	6.25	6.25	6.25
Test 2	2 h	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Final Exam	3 hours	41.25	46.25	46.25	51.25	47.5	52.5	52.5	57.5

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.

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

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.**

iClicker/Reef Polling

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

Points for responding to a concept poll in class:	2 points
<u>Points for the correct response:</u>	<u>1 point</u>
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 5.0:	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	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.

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, 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 Sept 8th and continue weekly for the rest of the term, with the exception of Fall Break (week of Oct 21st). Please see the course calendar for more details.

Laboratory

Details of the laboratory portions of this course can be found on the Brightspace site.

An important detail is that you must complete all activities of the laboratory portion to receive a passing grade in this course.

Please note: 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, labs that are submitted late for any reason (including but not limited to electronic submission issues) will receive a mark of 0 for the lab. 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.

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 Oct. 7 and Nov. 11 (which can and will likely include Friday evening, Saturday or Sunday).

The P.A.S.S. Program

This course is associated with the Peer Assisted Study Sessions (PASS) program. In this program, weekly workshops are delivered by a facilitator. The facilitator is a student who recently took CHEM 1001 (and did very well). PASS is not a remedial program - it is intended for ALL students in the course. More details will be given in the first lecture or two.

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 Mondays and Wednesdays from 1:00-2:00. Ben Warnes' office hours will be held on Thursdays from 10:00-11:00.
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.

Special Arrangements

You may need special arrangements to meet your academic obligations during the term. A link to the university's Academic Accommodations can be found here:

[/students.carleton.ca/course-outline/](https://students.carleton.ca/course-outline/)

For an accommodation request the processes are as follows:

Deferred term work: For short term (a week or less) incapacitation, students must complete and submit a self-declaration form (<https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf>) to Dr. Brock (david.brock3@carleton.ca) within 48 hours of the missed work. For approved missed tests, the weight will be transferred to the final exam.

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 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.

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.

Syllabus

1. Fundamental Concepts of Chemistry – this material is assumed from high school and is not covered in the course specifically.

Review it if necessary.

Atoms, Molecules, and Compounds
Measurements in Chemistry
Chemical Problem Solving
Counting Atoms: The Mole
Amounts of Compounds
Aqueous Solutions
Writing Chemical Equations
The Stoichiometry of Chemical Reactions
Yields of Chemical Reactions
The Limiting Reactant

4. Atoms and Light

Characteristics of Atoms
Characteristics of Light
Absorption and Emission Spectra
Properties of Electrons
Quantization and Quantum Numbers
Shapes of Atomic Orbitals

5. Atomic Energies and Periodicity

Orbital Energies
Structure of the Periodic Table
Electron Configurations
Periodicity of Atomic Properties
Energetics of Ionic Compounds
Ions and Chemical Periodicity

6. Fundamentals of Chemical Bonding

Overview of Bonding
Lewis Structures
Molecular Shapes: Tetrahedral Systems
Other Molecular Shapes
Properties of Covalent Bonds

7. Theories of Chemical Bonding

Localized Bonds
Hybridization of Atomic Orbitals
Multiple Bonds
Molecular Orbital Theory: Diatomic Molecules
Three-Centre π -Orbitals

Extended π Systems
Band Theory of Solids

8. Effects of Intermolecular Forces

Effects of Intermolecular Forces
Types of Intermolecular Forces
Liquids
Forces in Solids
Order in Solids
Phase Changes

2. The Behaviour of Gases

Pressure
Describing Gases
Gas Mixtures
Gas Stoichiometry
Molecular View of Gases
Additional Gas Properties
Non-Ideal (Real) Gases

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 K_{eq} from ΔG°
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 H_3O^+ Ions
Titration of Polyprotic Acids
Indicators
Solubility Equilibria
Precipitation Equilibria
The Common-Ion Effect
Effects of pH

	Monday	Tuesday	Wednesday	Thursday	Friday
September					
	2	3	4 Classes Begin	5	6 <i>Practice Quiz Due 11:55 pm</i>
Ch 1 FSR	9	10	11 <i>Quiz 1 Due 11:55 pm</i>	12	13
Ch 4	16 <i>Quiz 2 Due 11:55 pm</i>	17 <i>Last day for add/drop/swap</i>	18	19 <i>Mastering Chem. Assignment #1 Due 11:55 pm</i>	20
Ch 5	23 <i>Quiz 3 Due 11:55 pm</i>	24	25	26	27
October					
Ch 6	30 <i>Quiz 4 Due 11:55 pm</i>	1	2	3 <i>Mastering Chem. Assignment #2 due 11:55 pm</i>	4
Ch 7	7 <i>Quiz 5 Due 11:55 pm</i>	8	9	10	11 Test this week (date/time TBA)
Ch 8	14 Thanksgiving	15	16 <i>Quiz 6 Due 11:55 pm</i>	17 <i>Mastering Chem. Assignment #3 due 11:55 pm</i>	18
No Labs or Classes	21 Fall Break	22 Fall Break	23 Fall Break	24 Fall Break	25 Fall Break
Ch 2	28 <i>Quiz 7 Due 11:55 pm</i>	29	30	31	1
November					
Ch 14	4 <i>Quiz 8 Due 11:55 pm</i>	5	6	7 <i>Mastering Chem. Assignment #4 due 11:55 pm</i>	8
Review	11 <i>Quiz 9 Due 11:55 pm</i>	12	13	14	15 Test this week (date/time TBA) <i>Last day to withdraw</i>
Ch 15	18 <i>Quiz 10 Due 11:55 pm</i>	19	20	21 <i>Mastering Chem. Assignment #5 due 11:55 pm</i>	22
Ch 16	25 <i>Quiz 11 Due 11:55 pm</i>	26	27	28	29
December					
Review	2 <i>Quiz 12 Due 11:55 pm</i>	3	4	5 <i>Mastering Chem. Assignment #6 due 11:55 pm</i>	6 Classes End