

# General Chemistry 1 - CHEM 1001 A/B

Fall 2023

## Department of Chemistry

**Instructors:**  
**Dave Brock**  
**Peter Gordon**

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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. Barring any technical issues, the classes are also recorded and can be played back at any time.

### “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" 4<sup>th</sup> 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	Tutorial 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	1.5 h	12.5	12.5	12.5	12.5	6.25	6.25	6.25	6.25
Test 2	1.5 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	Tutorial 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	1.5 h	12.5	12.5	12.5	12.5	6.25	6.25	6.25	6.25
Test 2	1.5 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 10<sup>th</sup> and continue weekly for the rest of the term, with the exception of Fall Break (week of Oct 23<sup>rd</sup>). 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. 9 and Nov. 13 (which can 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. 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 vary week to week and will be posted in Brightspace at least one week in advance. Peter Gordon does not have fixed office hours but will respond promptly to requests to meet.
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 (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](mailto: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.

### Research Activities

Please note that grade data from CHEM 1001 will be collected, used and disclosed by Sydney Buttera, PhD, Post-Doctoral Researcher in the Department of Chemistry. The purpose of the research is to compare grade data from CHEM Matters (CHEM 0999) to CHEM 1001/1002 to determine the effectiveness of CHEM Matters and identify opportunities for course delivery improvement. In order to complete this study, Sydney Buttera will be receiving and extracting of grade data from the Brightspace Learning Management System. **No personal identifiers will be used when reporting on the study.** If you do not wish for your grades to be used by Dr. Buttera, please communicate with her by email ([sydney.buttera@carleton.ca](mailto:sydney.buttera@carleton.ca)) by September 30th, 2023.

## 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  $\pi$ -Orbitals

Extended  $\pi$  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  $\Delta G^\circ$   
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<sup>-</sup> Ions  
Titration of a Weak Base with H<sub>3</sub>O<sup>+</sup> Ions  
Titration of Polyprotic Acids  
Indicators  
Solubility Equilibria  
Precipitation Equilibria  
The Common-Ion Effect  
Effects of pH

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