CHEMISTRY 110 -001/002 - General Chemistry I

Fall 2024

Course Information

Credits: 4 credits (lecture + lab course)
Prerequisites/corequisites: High school level mathematics and physics or permission of instructor; CHEM 120 is not a prerequisite.

SUCCESS IN CHEMISTRY

We believe that anyone can do well in Chem110. Chemistry can be challenging – we want you to enjoy the challenge and learn about chemistry and its applications. We have added flexibility and repetition in the course and to the evaluation scheme to ensure you have chances to learn and improve throughout the semester. Quizzes and Reviews will help you keep up with the content regularly and prepare you for the timed assessment and final exam. Reviews are meant to be interactive (hence the attendance component). These small component assessments are designed purposefully to encourage interaction among students and help you learn the content by repetition.

INSTRUCTORS, TEACHING ASSISTANTS, AND MENTORS INFORMATION

Instructors Names and Emails

Prof. Ashok Kakkar	Prof. Maureen McKeague	Dr. Pallavi Sirjoosingh
Otto Maass 313	Pulp and Paper 104	Otto Maass 100

Contact: Email us at chem110-120.chemistry@mcgill.ca. Each instructor will be holding separate office hours. Details regarding those will be available on myCourses.

Teaching Assistants (TAs) Names and Emails

Mohammed Amin Belahouane	Aracelli Chang
Emma Groenwold	Nu Thuy Tu Ton
Yunxiang Yang	Vivian Zhang

Contact: Email us at chem110-120.chemistry@mcgill.ca

TEAM Mentors (details on myCourses)

SciLearn Peer Collab: TAs and TEAM mentors will be available for drop-in help sessions during scheduled SciLearn Peer Collab sessions. More details on times for the sessions will be posted on myCourses.

COURSE SCHEDULE AND INFORMATION

Lecture/Class Time

Concept videos will be posted on myCourses and should be viewed *ahead* of class time. The class times will focus on discussion/practice problems based on the content covered in the concept videos.

CHEM-110-001	Mon/Wed/Fri (Lea 132)	10:35 – 11:25 am
CHEM-110-002	Tue/Thu (Adams Aud)	11:35 - 12:55 pm

**** You can attend EITHER section without making any official changes on Minerva***

The content covered and all assessments are the same for the two sections.

Class time is focused on active problems-based learning led by instructors (In-class Problem Solving) or done in student groups (In-Class Reviews; graded). Please see the Schedule for dates of Reviews.

Reading Break: 14th to 18th October

Course Website

https://www.mcgill.ca/mycourses/
Click 'Log in to myCourses' and use McGill username and password
"Fall 2024 - CHEM-110-001 & CHEM-110-002" – Lecture
"Fall 2024 - CHEM-110/112 Labs" - Lab

Online Access Requirements

For all online platforms, it is important that you register and sign-in with your @mail.mcgill.ca email address. Using a different account (i.e., Gmail, iCloud, etc.) may result in issues with access and evaluation of your work.

COURSE MATERIAL

Slides/Concept Videos

Course slides will be available as PDF files on myCourses. We encourage you to add your own notes as you watch the Concept Videos.
Concept Videos for the week will be posted in advance. Active learning class will focus on the contents of the week's Concept Videos.

Textbooks (Open-Source Free Access Textbooks)

Chemistry: Atoms First from OpenStax, Print ISBN 1947172646, Digital ISBN 1947172638,
https://openstax.org/details/books/chemistry-atoms-first-2e (Required)
Your textbook is available in web view and PDF for free! You can also choose to purchase it on iBooks or get a printed version from OpenStax on Amazon.com. Web view is recommended format-- the responsive design works seamlessly on any device. If you buy it on Amazon, make sure you use the link on your book page on openstax.org so you get the official OpenStax print version. (Simple printouts sold by third parties on Amazon are not verifiable and not as high-quality.)
Print copies are also available at the McGill library. Please see the myCourses page for details on how to access the textbook.
Organic Chemistry: A Tenth Edition; John McMurry; Print ISBN-13 978-1-711471-85-3 Digital ISBN-13 978-1-951693-98-5
https://openstax.org/details/books/organic-chemistry (Suggested for Organic Section)

In-Class Polling 'Slido' (Recommended)

Polling will be used in this course as a self-check for your understanding of course content, to provide us with feedback, and to enhance your engagement in class.
During class, you will be asked to respond to questions (not graded) from the instructor from a personal device (smartphone, tablet, or laptop). Please come to class with your devices charged and connected to the internet. If you do not have a phone, tablet, or laptop to use for polling questions, and wish to participate, please contact the instructor immediately for appropriate arrangements to be made. Polling will be available through www.mcgill.ca/polling using your McGill username/password.

Practice Problems

We will post recommended problems from the back of the textbook, along with their solutions. We will also provide you with practice problems that we will work on together during the online active learning class. We strongly recommend you watch the Concept Videos before attempting the practice problems.

Calculator (Required)

This course will require the use of a calculator. Any stand-alone scientific calculator may be used for this course.
Usage of any personal electronic devices for in-person assessments/exams (for example: midterm or final exam) is prohibited.

COURSE EVALUATION

We encourage students to read the recent Policy on the Assessment of Student Learning (PASL) policy that applies to all undergraduate and graduate courses. The purpose of the Policy on Assessment of Student Learning (PASL) is to provide a set of common principles to guide the assessment of students' learning. Per PASL, assessment should be equitable and consistent, and promote effective learning experiences, a healthy learning environment, and academic integrity. Learn more on the For Students page of the PASL website. Also see Faculty of Science-specific rules on the implementation of PASL.

Grade Item	**Chem110**		**Chem 110 Lab Exempt**	
Labs	20%		N/A	
	Quizzes+Reviews = 15% **(Best of two choices)**		**Quizzes+Reviews = 25%** **(Best of two choices)**	
Quizzes	10%	15%	20%	25%
Reviews	5%	0%	5%	0%
	MT + Final = 65% **(Best of two choices)**		**MT+ Final = 75%** **(Best of two choices)**	
Midterm (MT)	20%	0%	20%	0%
Final Exam	45%	65%	55%	75%

Labs (REQUIRED COURSE COMPONENT)

The laboratory portion of the course counts for 20% of the overall course grade and is a required course component i.e. you must pass the lab to pass the course. Chemistry is a practical science, and the application of the fundamental principles you learn during the lectures is assessed through the hands-on labs. Performing experiments, collecting data, analyzing results, and preparing a lab report based on theoretical principles learned during lectures are essential learning objectives that a student in Chem110 must achieve.

If you fail the lab and pass the lecture, you will receive an "F" grade and must redo the entire course. Passing the lab entails fulfilling all the following three requirements:

- You must achieve greater than or equal to 55% in the lab component
- You cannot miss more than two labs.
- You must submit a satisfactory lab report after attending the lab.

Please read more details regarding the criteria for passing the labs on Page 11 of this document.

Lab Exemption: If you are repeating this course, you ***could*** be eligible for a lab exemption. You must have passed the lab component within the past 3 years. Contact the lab instructor Dr. Denisova to confirm your eligibility for a lab exemption and obtain authorization. *Lab grades are not transferred from previous years.*

Work submitted for evaluation as part of this course may be checked with text-matching software within MyCourses.

Quizzes

Quizzes are a type of formative assessment to monitor your learning regularly throughout the semester. ~Weekly timed multiple choice/multi-select quizzes will be held through myCourses. The quizzes will assess the content covered in the previous week(s).
You will have 1 attempt for each quiz. Each quiz will be timed and is worth 10 points (9 quizzes = 90 points total). The points for each quiz will be added together, and the total will be graded out of 70 points (Maximum points possible: 70). There will be no make-up or deferred quizzes.

Each quiz opens on Monday at 9:00 am and closes on Friday at 5:00 pm. You may start the quiz any time during the open time-window, but once open, the quiz is timed (60 minutes) and the quiz must be submitted before the due date/time.
Due dates for all quizzes are provided in the Schedule.
Quiz Grade and Feedback: The grade for each quiz, all the questions, and their answers, are released on myCourses after the quiz period is over. Quizzes are graded for correctness. There are no partial marks for incorrectly answered questions on the quiz. Incorrect answers receive a grade of 0. If a quiz is not submitted/attempted before the due date/time, a grade of 0 for that quiz is automatically recorded.

In-class Review (Attendance at 6 out of 9 review sessions required for full credit)

Reviews are a type of formative assessment to help you practice and review content regularly throughout the semester. Reviews are *not graded* for correctness.
9 Reviews will be held during class times – the dates for the Reviews are provided in the Schedule.
During the Review, students work on pre-assigned problems posted on myCourses.

Students can attend the Review for either section 001 or 002 each week.
Each review is worth ~0.833% (maximum up to 5%), so you need to attend and submit 6 Reviews out of the 9 scheduled to earn the maximum points. There are no make-up or deferred Review, but the Review grade is transferable to Quizzes (See below).

Review Grade and Feedback: To get full credit for each Review, students must attend the Review in-person and submit a credible attempt of one question (from the Review) on Crowdmark during class time. Failure to attend and/or failure to submit a Review will result in a grade of 0 for that Review. All solutions to the Review problems are released on myCourses after the Review is completed.
The grade for the Review is released on myCourses, but students may view their submission any time on Crowdmdark.

Quizzes and **In-Class Reviews** add up to 15% (25% for Lab Exempt) of your overall grade. At the end of the semester, your overall grade will be calculated using both schemes and the best option will be automatically applied to your final calculated grade. You do not need to make a choice.

Midterm Exam (MT) (Date: 7th November 2024; 6:30 to 8:30 PM)

Midterm exam is a summative assessment to evaluate your understanding of the learning objectives covered in ~first half of the course. The midterm exam will be administered **in-person** and consist of short-answer type questions assessing content covered up to the week before the midterm date. The questions will assess students' ability to understand concepts covered during the class and apply them to relevant context.

Representative practice midterm exams and answer keys will be posted on myCourses.

Seating assignments will be posted 24 hours before the exam date. More details will be available on myCourses closer to the date of the exam.

If you miss the midterm exam, the grade will be distributed to the final exam.

If you have a university-scheduled or a personal (extenuating illness or serious personal circumstances) conflict with the midterm exam, please email chem110-120.chemistry@mcgill.ca.

Final Exam (In-Person, Date: TBA)

Final exam is a summative assessment to evaluate your understanding of all the learning objectives in the lecture component of the course.

There will be a cumulative final exam during the final exam period. The date for the final exam is to be decided by the Exam Office. Room assignments/dates for the final exam are handled by the Exam Office (posted in November).

The exam will be in-person and ~3-hours long and consist of short and long-answer type questions assessing content covered throughout the entire semester. The questions will assess students' ability to understand concepts covered during the class and apply them to relevant context.

Representative practice exams and answer keys are posted on myCourses.

Please note that no instructor at McGill is authorized to alter the time/date of a final exam or to offer a special writing opportunity; these issues can only be dealt with at the McGill Service Point. If you have too many exams in a brief period of time, please consult: http://www.mcgill.ca/conted-students/exams/conflicts/

Midterm and Final Exam add up to 65% (75% for Lab exempt) of your overall grade. At the end of the semester, your overall grade will be calculated using the two schemes, and the best option will be applied to your final calculated grade. You do not need to make a choice.

ACADEMIC ACCOMMODATIONS: Legally mandated academic accommodations are handled by Student Accessibility and Achievement. For more information see https://www.mcgill.ca/access-achieve/

Midterm and Final Exam Grade and Feedback: We attempt to release the exam grades including detailed feedback on Crowdmark, within 2 weeks after the exam is complete. Due to the large number of students in the class, this may take longer. Students can request a regrade submission using the regrade submission form posted on myCourses and Crowdmark after the grade and feedback are released.

COURSE POLICY STATEMENTS

Policy Statement on Academic Integrity

McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the "Code of Student Conduct and Disciplinary Procedures" (Approved by Senate on 29 January 2003) (See McGill's guide to academic honesty for more information).

L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et procédures disciplinaires. » (Énoncé approuvé par le Sénat le 29 janvier 2003) (pour de plus amples renseignements, veuillez consulter le guide pour l'honnêteté académique de McGill.)

Policy Statement on Language of Submission

In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French written work that is to be graded. This does not apply to courses in which acquiring proficiency in a language is one of the objectives." (Approved by Senate on 21 January 2009)

« Conformément à la Charte des droits de l'étudiant de l'Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté, sauf dans le cas des cours dont l'un des objets est la maîtrise d'une langue. » (Énoncé approuvé par le Sénat le 21 janvier 2009)

Policy Statement on Extraordinary circumstances

In the event of extraordinary circumstances, the content and/or evaluation scheme in this course is subject to change.

Policy Statement on Course Material

Instructor-generated course materials (e.g., handouts, notes, summaries, exam questions, etc.) are protected by law and may not be copied or distributed in any form or in any medium without explicit permission of the instructor. Note that infringements of copyright can be subject to follow up by the University under the Code of Student Conduct and Disciplinary Procedures.

Policy Statement on Diverse Learners

As instructors of this course, we endeavor to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with us and the Student Accessibility and Achievement, 514-398-6009. Legally mandated academic accommodations are handled by Student Accessibility and Achievement.

Use of Generative AI

Students are encouraged to make use of technology, including generative artificial intelligence tools, to contribute to their understanding of course materials.

Students are discouraged, unless otherwise stated, to make use of artificial intelligence tools, including generative AI, to help produce assignments or reports. We believe that working through the assignments on your own will help you gain a better understanding of the course material and will better prepare you not only for the other course examinations, but also for the subsequent courses, internships, research opportunities, and jobs. However, students are ultimately accountable for the work they submit. Any content produced by an artificial intelligence tool must be cited appropriately. Many organizations that publish standard citation formats are now providing information on citing generative AI (e.g., MLA: https://style.mla.org/citing-generative-ai/).

Basic Needs

If you have difficulty affording food or if you lack a safe and stable place to live and believe that these circumstances may affect your performance in this course, we encourage you to contact the Dean of Students, who can connect you with support services. If you feel comfortable doing so, please let us know, so we can discuss how we can best support your learning.

Wellness

Many students may face mental health challenges that can impact not only their academic success but also their ability to thrive in our campus community. Please reach out for support when you need it from the Wellness Hub; wellness resources are available on campus, off campus, and online.

LEARNING OBJECTIVES AND COURSE SCHEDULE

Learning Objectives

Chemistry 110 aims to provide you with a solid understanding of the fundamental principles of atomic and molecular structure, the periodic table, valence, hybridization and molecular orbital theory, and introductions to organic and inorganic chemistry. Our focus is on understanding the basic chemical properties that link atoms to molecules and molecules to macroscale materials.

By the end of the semester, you will be able to:

- Understand and explain the wave-particle nature of matter and light
- Apply principles and perform calculations related to photoelectric effect and atomic spectra
- Describe the four quantum numbers and how they describe the distribution of electrons in an atom
- Relate the distribution of electrons in an atom to the position of the element on the periodic table
- Explain the properties of elements based on their position on the periodic table, and how/why elements from similar period/group exhibit similar/different properties (atomic/ionic size, ionization energy, electron affinity, electronegativity)
- Describe and differentiate ionic and covalent bonds
- Describe the bonding between atoms in a molecule and the overall shape of a molecule based on Lewis/VSEPR theory
- Determine hybridization of atoms in a molecule and relate it to the bonding of atoms within the molecule
- Explain bonding within a molecule based on hybridization and valence bond theory
- Draw Molecular Orbital Diagram for group 1 and 2 diatomics, and describe the bonding in these molecules
- Describe different intermolecular forces, and the effects of intermolecular forces on macroscopic properties
- Classify and name organic compounds, and identify functional groups
- Identify isomers and their relationship (structural/functional/conformational/configurational)
- Identify chiral compounds and determine absolute configuration at a chiral centre
- Identify major organic reaction types and their basic mechanisms (addition/elimination/substitution/rearrangement)
- Understand arrow-pushing in each reaction and identify products/reactants based on the provided mechanism
- Describe how electronic configuration of transition elements determine their properties
- Describe the bonding in coordination compounds and the properties of coordination compounds based on crystal field theory

Ch 1, 2, 6.1, and 6.2 are prerequisite material for Chem 110. Please review these chapters before the first class to confirm familiarity. All chapter numbers refer to the Textbook: https://openstax.org/details/books/chemistry-atoms-first-2e

Topics Covered by Dr. Sirjoosingh (August 28th to October 4th)

Quantum Theory and Atomic Structure (Chapter 3): Early Atomic Theory, Light Radiation, Atomic Spectra, Bohr Atom, Wave-Particle Duality of Matter and Energy, Blackbody Radiation, Photoelectric effect, Quantum Mechanical Model of the Atom

Electron Configuration and Chemical Periodicity (Chapter 3): Many Electron Atoms, Quantum Numbers, Electron Configurations, Constructing the Periodic Table, Periodic Trends

Models of Chemical Bonding and Shapes of Molecules (Chapter 4): Lewis Structures, Covalent and Ionic Bonds, Resonance, Bond Polarity, Bond Energy, VSEPR Theory, Molecular Shape and Polarity

Topics Covered by Prof. Kakkar (October 7th to November 1st)

Theories of Covalent Bonding (Chapter 5): Valence Bond Theory, Hybridization, Molecular Orbital Theory

Intermolecular Forces (Ch 10.1): Polarizability, Induced Dipoles, Dispersion Forces, Ion-Dipole/Dipole-Dipole Interactions, Hydrogen Bonding

***Topics Covered by Prof. McKeague (November 4th to December 4th)**

Organic Compounds (Ch 21 and recommended readings from Organic Chemistry Textbook): Characteristics of Organic Molecules, Common Functional Groups, Drawing Hydrocarbons, Conformations of Alkanes, Stereochemistry

Intro to Reactions (Recommended readings from Organic Chemistry Textbook): Introduction to Reactions and Applications (Please refer to the lecture notes and content therein for this portion of the course)

Transition Elements and Their Coordination Compounds (Ch 19): Properties of Transition Metals, Ligands and Coordination Compounds, Crystal Field Theory

*For the organic chemistry section of the course covered by Prof. McKeague, please refer to the lecture notes and content therein, but some additional readings from the Organic Chemistry Textbook will be recommended as well.

Questions regarding the material covered in each section should only be referred to the instructor who is responsible for that section during their office hours or through email (chem110-120.chemistry@mcgill.ca).

LABORATORY (SEE LAB SYLLABUS FOR MORE DETAILS)

Lab Instructor	Lab Coordinator
Dr. Irina Denisova	Badawy Sha'ath
Otto Maass 1	Otto Maass 1
irina.denisova@mcgill.ca	badawy.shaath@mcgill.ca

**** For any general questions related to the labs, email Dr. Denisova.***

**** For any questions related to rescheduling missed labs, email Mr. Sha'ath.***

The laboratory counts for 20% of the course grade but is a required course component. If you fail the lab and pass the lecture, you will receive an "F" grade and must redo the entire course.

Passing the lab entails fulfilling all of the following three requirements:

- You must achieve greater than or equal to 55% in the lab component.
- You cannot miss more than two labs.
- You must submit a satisfactory lab report after attending the lab.

If you miss more than two labs without making it up, it will result in an automatic failure of the lab course component.
"There are six (6) in-person labs in total.
Missing 3 labs (or more) is equivalent to missing 50% (or more) of the in-person labs, and therefore the following learning objectives are not achieved:

- Apply and connect theoretical concepts to laboratory practice of chemistry.
- Acquire basic chemistry laboratory technical skills such as using an electronic balance, preparing a solution of a given concentration, pipetting, preparing serial dilutions, etc.
- Properly use basic chemistry laboratory equipment and instruments such as glassware, balance, spectrometer, etc.

Lab report is an essential part of a laboratory experiment. It is required for the students to achieve the following learning objectives:

- Interpret and analyze acquired laboratory data
- Recognize reliability of data
- Formulate conclusions based on data and analyses, and clearly communicate results through report writing