



CHMA10H3: Introductory Chemistry I
Winter 2021 Syllabus
University of Toronto at Scarborough

Dear Students,

Welcome to Introductory Chemistry Part I! Our primary goal is to ignite your passion for chemistry by creating a meaningful learning environment with many real life applications of chemistry. The knowledge you gain in this course is applicable in diverse disciplines, including Medicine, Pharmacy, Environmental Sciences, Neuroscience, Biochemistry and Biology. We are looking forward to teaching you many interesting topics on molecular structure, chemical reactions and nuclear chemistry. Please read the course syllabus to understand the learning expectations and assessment methods. Looking forward to meeting all of you! Although there are no pre-requisites for this course, it is highly recommended that you have completed grade 12 Chemistry and Grade 12 Advanced Functions or Grade 12 Calculus. The lectures for this course are three times a week for one hour and you are strongly encouraged you to attend all the lectures to engage in the participatory lessons!

Instructor and Lab Manager

Dr. Marco Zimmer-De Iuliis

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Office Hours: TBA

Email Policy

Please use the following guidelines when sending emails:

- i. Use your "utoronto.ca" email account for all your correspondences. If other accounts (Yahoo, Gmail, Hotmail, etc.) are used, your email will be filtered out as spam and may not be received.
- ii. Put "*CHMA10*" in the subject line followed by the reason for the email and use professional language with a formal greeting.
- iii. Sign the email with your first and last name. Include your student ID number after your name.

Every effort will be made to respond to student emails within 36 hours (M-F) provided that the above protocol is used.

Required Text Book

Chemistry: A Molecular Approach, 3rd Canadian Edition, by Nivaldo J. Tro, Travis D. Fridgen, Lawton E. Shaw, Pearson Canada Inc.

Synchronous Lectures

LEC01: Mondays, Wednesdays, and Fridays from 10:00 am – 11:00 am

These lectures will be streamed via Bb Collaborate and will also be recorded. It is **strongly encouraged** that you attend all the lectures to engage in the participatory lessons.

Website

CHMA10H3 maintains a Quercus web space, which archives a variety of course related information including: grades, class announcements, lectures and lab materials. Class e-mails will be sent periodically to your “utoronto.ca” e-mail account. **To login**, go to: <https://q.utoronto.ca>. Login using your UTORid username and password. Then click on the CHMA10 link.

Announcements

Official announcements regarding test schedule, material covered for each test and other important information will be posted on the CHMA10H3 course web site. It is absolutely your responsibility to check these postings regularly for important announcements. Deadlines are regularly announced and if you miss a deadline, there is no option to hand it in late.

Accessibility

Students with diverse learning styles and needs are welcome in this course. If you require accommodations for a disability, or have any accessibility concerns about the course or course materials, please contact us and or the Accessibility Services as soon as possible: SW 302, (416) 287-7560 or ability@utsc.utoronto.ca

Health & Wellness at UTSC

As a University of Toronto student, you have complete access to The Health & Wellness Centre at UTSC. The Health & Wellness Centre at UTSC has health care providers who provide medical, nursing, counselling, health promotion and education services. Any student with a current student card and a valid health card can use these services. If you have an mental or physical health concerns, there is help available and you may call 416-287-7065 or email health-services@utsc.utoronto.ca to book an appointment.

Peer Facilitator Program (run through Quercus)

Facilitated Study Group (FSG) is being run through the Centre for Teaching and Learning. These sessions are open to all students taking this course who want to improve their understanding of course material, improve their study techniques, and improve their grade. Attendance is voluntary. In these sessions you will discuss important concepts, develop study strategies, and prepare for exams and assignments on course material. Course material is NOT re-lectured. The FSG's are led by a trained facilitator who has previously taken the course. A survey will be taken during the first week of class to determine the best days and times for most students, and they will begin probably the 2nd or 3rd week of class.

Online Tutorial Component of CHMA10

Online CHMA10 tutorials are designed to help students practice additional problems to meet the learning objectives of each lecture module. The tutorials will be held weekly on Bb Collaborate, starting from the second week of classes. Additional details on the format of the tutorial sessions and

schedule will be available on the course Quercus page in the first week of classes. Although, there are no grades associated with the online tutorial sessions, you are strongly encouraged to attend the tutorial sessions for the betterment of your learning.

Writing Assignment: Peer Reviewed Mock Journal using PeerScholar

You will be asked to write an essay with the goal of exploring modern topics in chemistry. You will learn how to utilize both UofT Library resources and Web of Science while also training writing skills. You will convey your research and learning on your topic with a peer-reviewed 500-word essay.

The peer-review process is the cornerstone of writing and communicating new results and ideas in the sciences. A part of this process heavily depends on you! You will be asked to apply critical thinking skills to give and receive feedback to fellow colleagues. You will experience this process while doing this assignment by using PeerScholar and online learning modules that will guide you throughout the various components of the assignment. The assignment will be worth 15% of your final grade. The assignment is divided in three phases. The breakdown of due dates and marks are shown below.

	Weight	Date Due by:
Completion of Quercus module		
Writing Assignment Guidelines	1%	11:59 pm EST on February 14 th , 2020
Guided Tour of Essay	1%	11:59 pm EST on February 14 th , 2020
Feedback (giving and receiving)	2%	11:59 pm EST on February 14 th , 2020
Web of Science	1%	11:59 pm EST on February 14 th , 2020
References	1%	11:59 pm EST on February 14 th , 2020
Essay and Feedback		
Draft Essay		Starts: 9 am EST on January 18 th Ends: 11:59 pm EST on February 14 th , 2020
Feedback (marked on quality of the peer-feedback)	3%	Starts: 9 am EST on February 15 th Ends: 11:59 pm EST on February 28 th
Final essay	6%	Starts: 9 am EST on March 1 st Ends: 11:59 EST on March 15 th
	Total = 15%	

You can find much more detail about the writing assignment on the CHMA10 Quercus page.

Post-Lecture Summaries

At the end of each week, you will be assigned a quiz where you will be asked to write a concise summary of 250 words or less of the 3 lectures from that week of the course. You may want to write about an important theory or concept. Perhaps you want to outline a particular problem-solving technique. Another option would be to give the key points or list one of the challenges you had with the topics being discussed. Each quiz will be available for 7 days. You will be given a grade of 2 % towards your final grade if you finish 7 of these assigned quizzes. This mark is NOT on a sliding scale. You must complete 7 of the summaries to be awarded the 2 % on your final grade. The schedule for the summaries is as follows:

Summary	Due Date
Lecture Summary #1 for Week 1	January 22 @ 11:59 pm EST
Lecture Summary #2 for Week 2	January 29 @ 11:59 pm EST
Lecture Summary #3 for Week 3	February 5 @ 11:59 pm EST
Lecture Summary #4 for Week 4	February 12 @ 11:59 pm EST
Lecture Summary #5 for Week 5	February 25 @ 11:59 pm EST
Lecture Summary #6 for Week 7	March 5 @ 11:59 pm EST
Lecture Summary #7 for Week 8	March 12 @ 11:59 pm EST
Lecture Summary #8 for Week 9	March 19 @ 11:59 pm EST
Lecture Summary #9 for Week 10	March 26 @ 11:59 pm EST
Lecture Summary #10 for Week 11	April 2 @ 11:59 pm EST
Lecture Summary #11 for Week 12	April 9 @ 11:59 pm EST

Assessment and Grading Practices:

Graded Work	Weight (%)
Writing Assignment	15
Post-Lecture Summaries	2
Term Test #1	14
Term-Test #2	14
Final Exam	35
Lab	20
FINAL MARK	100

To pass the course, you **MUST** pass the laboratory **AND** either both term tests or the final exam (and receive a final grade of 50+, of course!). The laboratory component of CHMA10 is **compulsory**.

Term-Test and Exam Policy:

Term-Tests

There will be 2 term tests that will count as 28% of your final grade (14% each). These tests will be written outside of class time. The exact date and time will be announced as soon as this information is made available from the registrar. The term-tests will be administered online via Quercus. They will be a mixture of numerical answers, multiple choice, and multiple answer questions.

Final Exam

There will be a **cumulative** exam written during the end of semester exam period. The exact date and time will be announced as soon as they are available. **Please note that if you miss the Final Exam, you must petition the Registrar's Office to write a make-up exam in the next formal exam period.** Check the UTSC Calendar for instructions and deadlines. The final exam will be administered online via Quercus.

Allowed Aids

Only non-programmable, non-communicating calculators are allowed in tests and exams for this course (both lecture and lab). Students **must** use their own calculators.

Policy on Missed Term-Tests

Should you miss one term test due to a legitimate reason, the weight of the missed test will be transferred to the other test. You must submit appropriate documentation *within one week of your absence*. If the reason is medical, an official UTSC medical form should be downloaded from http://www.utsc.utoronto.ca/~registrar/resources/pdf_general/UTSCmedicalcertificate.pdf and completed by your doctor. **If no acceptable documentation is received, you will receive a grade of zero for that test.** With a validated absence, you will be allowed to write a make-up test.

Cases in which **both** the regularly scheduled term test and make-up test were missed due to legitimate reasons will be dealt with on a case-by-case basis. Please note that in UTSC Calendar it states: "You cannot petition to withdraw from a course on the grounds that no work was returned to you before the last day to withdraw without academic penalty if this is the result of your having been given an extension to complete your work for reasons relating to you and not the rest of your class."

Academic Integrity

Academic integrity is one of the cornerstones of the University of Toronto. It is critically important both to maintain our community which honours the values of honesty, trust, respect, fairness and responsibility and to protect you, the students within this community, and the value of the degree towards which you are all working so diligently. Detailed information about how to act with academic integrity, the Code of Behaviour on Academic Matters, and the processes by which allegations of academic misconduct are resolved can be found online: <https://www.academicintegrity.utoronto.ca/> According to Section B of the University of Toronto's Code of Behaviour on Academic Matters <http://www.governingcouncil.utoronto.ca/policies/behaveac.htm> which all students are expected to know and respect, it is an offence for students to:

- To use someone else's ideas or words in their own work without acknowledging that those ideas/words are not their own with a citation and quotation marks, i.e. to commit plagiarism.

- To include false, misleading or concocted citations in their work.
- To obtain unauthorized assistance on any assignment.
- To provide unauthorized assistance to another student. This includes showing another student completed work.
- To submit their own work for credit in more than one course without the permission of the instructor.
- To falsify or alter any documentation required by the University. This includes, but is not limited to, doctor's notes.
- To use or possess an unauthorized aid in any test or exam.

There are other offences covered under the Code, but these are by far the most common. Please respect these rules and the values which they protect. Offences against academic integrity will be dealt with according to the procedures outlined in the Code of Behaviour on Academic Matters.

CHMA10H3 Lecture Schedule (*Tentative):

Week	Topic(s)	Suggested Reading
1	Introduction to Quantum Model of the Atom	7.1-7.3
2	Quantum Model of the Atom	7.4-7.7 (excluding Particle in a Box)
3	Periodic Trends of the Elements	8.1 – 8.9
4	Introduction to Enthalpy of Reactions Chemical Bonding I	6.8-6.9 9.1-9.6
5	Chemical Bonding I / Chemical Bonding II	9.6-9.10; 10.1-10.2
February 15 th -19 th	READING WEEK	N/A
6	Chemical Bonding II	10.3-10.7
7	Chemical Bonding II / Liquids, Solids, Intermolecular Forces	10.8; 11.1-11.4
8	Liquids, Solids, Intermolecular Forces	11.1 - 11.4
9	Redox Reactions and Stoichiometry	15.6; 4.3-4.5
10	Gas Laws	4.6-4.9
11	pH, Acids and Bases, Precipitation Reactions	5.1-5.10

12	pH, Acids and Bases, Precipitation Reactions	5.1-5.10
13	Special Topics (to be decided)	
April 4 th – 7 th	Study Break	
April 8 th – 25 th	Final Exam Period	

Lecture Topics and Learning Outcomes

Below is a list of topics that will be covered in this course, along with the corresponding chapters and learning outcomes.

- 1. The Quantum-Mechanical Model of the Atom (Chapter 7):** Students will be able to
 - i. Explain the need for the development of the quantum mechanical model of the atom and the key scientists who made major contributions to its development.
 - ii. describe the evidence for the wave/particle duality of electrons and photons.
 - iii. Be able to describe the electronic configuration of an atom or ion using the four quantum numbers.
 - iv. Be able to describe radial and angular nodes in atomic orbital
 - v. Recognize how the quantum mechanical model of the atom is reflected in how the periodic table is organized.
 - vi. Use Hund's rule and the Aufbau principle to write electron configurations for atoms and ions.

- 2. Periodic Properties of the Elements (Chapter 8):** Students will be able to
 - i. Write electron configurations from the periodic table and relate quantum numbers to the location of elements in the periodic table.
 - ii. Estimate the effective nuclear charge, Z_{eff} , and use it to explain and predict trends in:
 - Atomic size
 - Ionic size
 - Relative ionization energies
 - Electron affinity
 - iii. Recognize periodic behavior of the elements.
 - iv. Identify the three main types of chemical bonds and how to classify them based on electronegativity

- 3. Thermochemistry (Chapter 6):** Students will be able to
 - i. Apply Hess's Law to calculate changes in enthalpy from $\Delta_r H$ of a reaction or from standard enthalpies of formation.

- 4. Chemical Bonding I: Lewis Theory (Chapters 9):** Students will be able to
 - i. apply the key concepts related to Lewis theory, such as electron dot structures, octet rule, resonance and formal charges.
 - ii. Identify and explain ionic, covalent, and metallic bonding.
 - iii. calculate lattice energies of ionic compounds.
 - iv. draw Lewis structures of atoms, ions, and simple covalent molecules, as well as resonance structures; assign formal charges and assess competing resonance structures.

- v. compare and rationalize differences in bond length, bond vibrations, bond energy, and bond polarity.
- vi. recognize and understand exceptions of octet rule.

5. Chemical Bonding II: Molecular Shapes, Valence Bond & Molecular Orbital Theory (Chapter 10):

Students will be able to

- i. Explain what VSEPR theory is and apply it to describe and predict electron geometry, molecular geometry, and the molecular polarity.
- ii. Predict properties such as boiling point or melting point from the molecular geometry of a molecule.
- iii. explain the fundamentals of Valence Bond Theory with a focus on the concepts of hybridized atomic orbitals, σ bonds and π bonds.
- iv. write hybridization and bonding schemes using Valence Bond Theory.
- v. explain the basic concepts of Molecular Orbital (MO) Theory, especially the linear combination of atomic orbitals (LACOs) approach
- vi. differentiate between bonding and antibonding orbitals and non-bonding orbitals.
- vii. draw MO diagrams for simple diatomic molecules and predict the bond order and magnetism of such molecules.

6. Liquids, Solids and Intermolecular forces (Chapter 11): Students will be able to

- i. describe the types of intermolecular forces and use them to explain and understand the physical properties of substances such as surface tension, viscosity and capillary action.
- ii. interpret vapor pressure curves and determine heat of vaporization using the Clausius–Clapeyron Equation 2-Point Form.
- iii. read and interpret heating curves and perform calculations based on data extracted from heating curves.

7. Gases (Chapter 5): Students will be able to

- i. Rationalize the macroscopic properties of gases in terms of the kinetic molecular theory
- ii. Explain the relationships between temperature, volume, pressure, and quantity in terms of the kinetic molecular theory
- iii. Interpret barometer and manometer readings
- iv. Use the gas law equations to calculate pressure, temperature, volume, density, molar mass and/or amount of gas in both static and changing systems
- v. Apply the ideal gas law and Dalton's law of partial pressures to solve for properties of gas mixtures, including gas samples collected over water
- vi. Predict relative rates of diffusion/effusion for different gases and/or temperatures; use relative diffusion/effusion rate data to calculate relative molecular masses/molecular speeds
- vii. Interpret non-ideal behaviour of gases in terms of the kinetic molecular theory and its short-comings; predict the extent of non-ideal behaviour for different gas samples

viii. Calculate properties for real gases using the van der Waals gas equation

8. Chemical Reactions and Stoichiometry (Chapter 4): Students will be able to

i. Acid/base Chemistry

- Explain the pH scale and how it relates to water at equilibrium.
- pK_a scale and how it relates to acidity
- strong acids and bases
 - write balanced neutralization reactions as well as reactions that evolve gases.
- Functional groups and organic acids
- Weak acids and bases
- Lewis Acids and Bases

ii. Precipitation

- Predict solubility and write precipitation reactions

iii. Solve stoichiometry problems involving gases

iv. Redox

- Identify oxidation states and balance redox reaction in both acid and base solution.

v. Determine the limiting reagent in a reaction as well as calculating the theoretical and percent yields.

vi. Determine solution concentrations and dilutions.

Online Laboratory Component of CHMA10

The goals of this virtual lab program are to train you on safe laboratory practices and help you understand the fundamental chemistry laboratory techniques. The laboratory modules are designed to navigate you through safety training and the experiments. The experiment modules are designed to teach the theory and lab techniques and assess your knowledge. Labs are directly or indirectly connected to the first-year chemistry content. As part of the pre-lab work, **you may be expected to read a recommended section from the textbook.**

The synchronous session of the virtual lab will commence 10 min past the hour of the scheduled time for your practical on **Bb Collaborate**. You are encouraged to arrive on time for your assigned session. The synchronous laboratory periods are 60 min in length and run every other week. If you are unable to attend the synchronous lab session during the scheduled hours, you can watch the recorded sessions after every lab to follow up with the instructions and complete the assigned tasks. The remaining 120 minutes of the scheduled lab period is allocated for you to asynchronously complete post-lab work (your post notebook report and your post lab report sheet).

It is **mandatory** to pass the lab component of the course to be eligible to pass the course. The lab component is worth 20% of your course grade.

Lab Manual and Notebook

You will be required to maintain a hardcover with a recommended dimension of 10.5" x 8.0" (**or similar**) to keep a record of all of your lab work. **Please note: Your notebook does not need to have the exact dimension. A hardbound notebook with standard letter-size lined papers is will be sufficient.**

You are required to fill in the following information on your notebook. Scan and submit the notebook report online for each experiment on the same day as the due date and time of the post-lab report sheet. If you do not have access to a scanner, you can take images of the report and combine it into one readable PDF document.

Laboratory Marking Scheme

The laboratory component is worth 20% of your final grade. The laboratory component is marked out of 100 total marks.

	% of final grade	Marks out of 86
Pre-Lab Notebook Report [scanned file upload] + Post-Lab Notebook Report [scanned file upload]	5 %	2 marks (x 5)
Pre-Lab Quiz [Quercus Quiz] (available online 3 days before your lab)	5 %	6 marks (x 5)
Post-Lab Report	7.5 %	8 marks (x 5)
Lab Exam	2.5%	6 marks
Total Marks:	20 %	86

*****You must receive a passing grade in the laboratory section to pass the course***

Lab Safety

Safety in the laboratory is an extremely important element in the chemistry program at this University. Failure to follow safe practices can cause laboratory accidents which may result in the loss of time, damage to clothing and other property, and most importantly personal injury. By following suitable precautions, you can anticipate and prevent situations that would otherwise lead to accidents.

Even though, you are not attending the lab practical in person this academic term, it is mandatory that you understand the safety lab practices to apply in future chemistry labs. Students registered in CHMA10H3F will be automatically enrolled in the WHMIS Training course. Once the WHMIS course is made available, an email announcement will be sent and a link to the course will appear in your Quercus home page. As part of this course, you will be expected to watch a couple of safety videos (approximately 90 minutes long in total) and take a multiple-choice quiz on the information covered in the videos. You must obtain 80% on the quiz to pass the WHMIS course. **In addition, you will be required to print off your quiz results and e-mail them to your TA before the start of your first lab period.**

Absence from the Synchronous Lab Session

If you are unable to attend the synchronous lab session online due to time zone difference or for any Professor Marco Zimmer De Iuliis (m.zimmer.deiuliis@utoronto.ca) and you are responsible for watching the recorded lab sessions and completing the experimental modules on time to meet the due dates in **Eastern Standard Time (EST)**. There are no make-up synchronous lab sessions. **Late submission of any pre or post lab assessments will not be accepted.**

If you are unable complete the pre- or post-lab assignments due to a valid reason (e.g. medical), you must provide the appropriate documentation (e.g. A UTSC medical certificate signed by a physician) **within 5 days of the due date of the assignment** for consideration to be excused from the lab assignment and have the grade weight added onto the oral lab exam. After the 5 days, the documentation will not be accepted and you will receive a grade of zero for all components of the lab.

If a student misses a lab assignment and provides no reasonable explanation or supporting documentation, a mark of zero will be assigned.

Students must complete at least 3 out of the 5 lab modules in order to be eligible to pass the course.

- If a student misses one experiment module assessments (pre & post), and provides appropriate documentation, the weight of that experiment will be added onto the oral lab exam.
- If a student misses two experimental module assessments (pre & post), and provides appropriate documentation, the weight of both experiments will also be added onto the oral lab exam.
- **If a student misses a third experimental lab module, even if they provide appropriate supporting documentation, they will automatically fail the lab component and therefore will automatically fail the course.**