CHMA10H3: Introductory Chemistry I
Winter 2022 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 is no pre-requisite 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 to attend all the lectures to engage in the participatory lessons!

Course Instructor and Lab Coordinator

Prof. Nirusha Thavarajah, HBSc., MEd., LL.M (IP), Ph.D.
Office Room Number: EV554
Email: nirusha.thavarajah@utoronto.ca
Office Hours: Mondays, Tuesdays and Wednesdays from 11:10 am-12:00 pm.

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 may be filtered out as spam and thus 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 followed.

Required Text Book

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

Lecture Delivery

Lectures will be streamed synchronously via Zoom until the end of January. Updates on the lecture format (in-person or online) for the remainder of the term will be announced at a later date. Please check the class announcements regularly for updates.

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.

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

Peer Facilitator Program (run through Quercus)

Facilitated Study Groups (FSG) are 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. During FSGs, you will discuss important concepts, develop study strategies, and prepare for exams and assignments on course material. Course material is NOT re-lectured. The FSGs 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 Zoom or MS Teams, 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 12% of your final grade. Below is the breakdown of those marks:

	Weight	Date Due by:
Completion of Quercus module		
Writing Assignment Guidelines	0.5%	11:59 pm EST on February 1st, 2022
Guided Tour of Essay	0.5%	11:59 pm EST on February 1st, 2022
Feedback (giving and receiving)	1%	11:59 pm EST on February 1st, 2022
SciFinder	0.5%	11:59 pm EST on February 1st, 2022
References	0.5%	11:59 pm EST on February 1st, 2022
Essay and Feedback		
Phase 1: Draft Essay		**Starts**: 9 am EST on January 17th , 2022 **Ends**: 2:00 pm EST February 15th , 2022
Phase 2: Quality and participation in the peer-feedback process	3%	**Starts**: 9 am EST on February 16th, 2022 **Ends**: 2:00 pm EST on February 28th , 2022
Phase 3: Final essay	6%	**Starts**: 9 am EST on March 2nd 2022 **Ends**: 2:00 pm EST on March 9th 2022
	Total = 12%	

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

Assessment and Grading Practices:

Graded Work	**Weight (%)**
Online Homework Assignments (4 in total; additional details will be available on Quercus)	8
Writing Assignment	12
Term Test #1	20% combined: One will be worth 8% and the other 12%. The term test with the higher grade will be assigned to be 12% while the term test with the lower grade will be assigned 8% of your final grade.
Term-Test #2	
Final Exam	35
Lab	25
FINAL MARK	**100**

To pass the course, you **MUST** pass the laboratory **AND** achieve either combined average of 50% from 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 20% of your final grade. One will be worth 8% and the other 12%. The term test with the higher grade will be assigned to be 12% while the term test with the lower grade will be assigned 8% of your final grade. 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. To ensure you pass the course, you should aim to have a combined average of 50% or greater from both term tests.

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.

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.

MISSED EVALUATIONS (TERM TESTS & ASSIGNMENTS)

For missed term work due to illness, emergency, or other mitigating circumstances, please follow the procedures outlined below.

Notes:

- The following reasons are not considered sufficient for missed term work: travel for leisure, weddings, personal commitments, work commitments, human error.
- Missed Final Exams are handled by the Registrar's Office and should be declared on eService: http://www.utsc.utoronto.ca/registrar/missing-examination
- Instructors cannot accept term work any later than five business days after the last day of class**.** Beyond this date, you would need to file a petition with the Registrar's Office: https://www.utsc.utoronto.ca/registrar/term-work

Accommodations for Illness or Emergency, Religious Conflicts

For missed work due to ILLNESS, EMERGENCY, or RELIGIOUS CONFLICTS please complete the following process:

1. Complete the **Request for Missed Term Work Form**
2. **Declare your absence** on ACORN (Profile & Settings > Absence Declaration)

Deadline: You must complete the above form **within 5 business days** of the missed work.

Accommodations for Academic Conflicts, Time Zone Conflicts

For missed term work due to an ACADEMIC CONFLICT (i.e. two quizzes or tests scheduled at the same time), please complete the following process:

1. Complete the **Request for Missed Term Work Form** choosing "Other" as your reason for missed work and explaining the conflict in the space provided.

Deadline: You should report the conflict **at least two weeks (10 business days) before the date of the activity,** or as soon as possible if it was not possible to identify the conflict earlier.

Note: Multiple assignments due on the same day are not considered conflicts. Accommodations may only be possible in the case of quizzes and tests that are both scheduled during the same discrete period. Back-to-back tests/quizzes are not considered conflicts.

Note: Students are responsible for keeping their course timetables conflict-free. Students who choose to register in two synchronous courses with overlapping lecture/tutorial/lab schedules may not necessarily be accommodated.

After submitting your documentation:

You are responsible for checking your Quercus course announcements daily, as accommodations may be time-critical.

You should continue to work on your assignments to the best of your ability, as extension accommodations may be as short as one business day, depending on the nature of the illness/emergency.

If an accommodation has been granted but you are unable to meet the conditions of the accommodation (ex. you need a longer extension, or you missed a make-up test), you will need to repeat the missed term work procedure and submit additional forms to request further accommodation. Note that in the case of a missed make-up test, an opportunity to write a second make-up test may not be provided.

Completion of this form does not guarantee that accommodations will be made. The course instructor reserves the right to decide what accommodations (if any) will be made. Failure to adhere to any aspect of this policy may result in a denial of your request for accommodation.

Missed Accommodations

If an accommodation is granted but a continued illness/emergency prevents you from meeting the requirements of your accommodation, you must repeat the missed term work procedure to request additional accommodations.

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	pH, Acids and Bases, Precipitation Reactions	15.6; 4.3-4.5
5	Redox Reactions and Stoichiometry	4.6-4.9
February 22nd – 25th	READING WEEK	N/A
6	Gas Laws	5.1-5.10
7	Introduction to Enthalpy of Reactions Chemical Bonding I	6.8-6.9 9.1-9.8
8	Chemical Bonding I / Chemical Bonding II	9.9-9.10; 10.1-10.2
9	Chemical Bonding II	10.3-10.7
10	Chemical Bonding II / Liquids, Solids, Intermolecular Forces	10.8; 11.1-11.8
11	Liquids, Solids, Intermolecular Forces / Nuclear Chemistry	11.1 - 11.8
Week 12	Nuclear Chemistry	19.6-19.12;
April 9th- April 12th	Study Break	
April 13th- April 29th	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. Recognize how the quantum mechanical model of the atom is reflected in how the periodic table is organized.
    v. 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, Zeff, 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. **Chemical Reactions and Stoichiometry (Chapter 4):** Students will be able to
    i. Explain the pH scale and how it relates to water at equilibrium.
    ii. Recognize and balance different types of chemical reactions including:
        - Acid/base: Identify strong acids and bases and write balanced neutralization reactions as well as reactions that evolve gases.
        - Precipitation: Predict solubility and write precipitation reactions
        - Redox: Identify oxidations states and balance redox reaction in both acid and base solution.
    iii. Determine the limiting reagent in a reaction as well as calculating the theoretical and percent yields.
    iv. Determine solution concentrations and dilutions molarity.

4. **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. Solve stoichiometry problems involving gases
    vi. 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
    vii. 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
    viii. 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
    ix. Calculate properties for real gases using the van der Waals gas equation

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

6. **Chemical Bonding I: Lewis Theory (Chapters 9):** Students will be able to
    a) learn the key concepts related to Lewis theory, such as electron dot structures, octet rule, resonance and formal charges.
    b) Identify and explain ionic, covalent and metallic bonding; calculate lattice energies of ionic compounds.
    c) draw Lewis structures of atoms, ions and simple covalent molecules, as well as resonance structures; assign formal charges and assess competing resonance structures.
    d) compare and rationalize differences in bond length, bond vibrations bond energy and bond polarity.
    e) recognize and understand exceptions of octet rule.

7. **Chemical Bonding II: Molecular Shapes, Valence Bond & Molecular Orbital Theory (Chapter 10):** Students will be able to
    i. learn VSEPR theory and be able to apply VSEPR to describe and predict electron geometry, molecular geometry, and the molecular polarity.
    ii. learn the fundamentals about Valence Bond Theory, in particular, the concepts of hybridized atomic orbitals, σ bond and π bond; write hybridization and bonding scheme using Valence Bond Theory.
    iii. learn the basic concepts of Molecular Orbital (MO) Theory, especially the linear combination

of atomic orbitals (LACOs) approach; understand bonding orbital vs antibonding orbital; draw MO diagram, and predict bond order and magnetism of diatomic molecules.

8. **Liquids, Solids and Intermolecular forces (Chapter 11):** Students will be able to
   a) 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.
   b) interpret vapor pressure curves and determine heat of vaporization using the Clausius–Clapeyron Equation 2-Point Form.
   c) read and interpret heating curves and perform calculations based on data extracted from heating curves.

9. **Radioactivity and Nuclear Chemistry (Chapter 19) :** Students will be able to
   i. understand major types of radioactivity, including α decay, β decay, γ ray emission, positron emission and electron capture; write nuclear equations of each type of radioactivity.
   ii. understand the concept of the Valley of Stability; predict the stability and types of radioactivity of given isotopes.
   iii. learn measurements of radioactivity, kinetics of radioactive decay and radiometric dating.
   iv. understand nuclear fission and nuclear fusion, and calculate energy associated with nuclear reactions based on mass defect and nuclear binding energy.
   v. learn the safety effects of radiation, and major applications of radioactivity in medicine and energy.

Laboratory Component of CHMA10

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

The goals of the 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 experiments. The experiments are designed to teach fundamental lab techniques that lay a strong foundational knowledge for students to apply the techniques in upper-level chemistry courses.

The theory required to understand the experiments are directly or indirectly connected to the first-year chemistry content. Therefore, as part of the pre-lab work, **you may be expected to read a recommended section from the textbook.** It is **mandatory** to pass the lab component of the course to be eligible to pass the course. The lab component is worth 25% of your course grade.

Lab Schedule

The first experiment will be done online. The Synchronous Online Laboratory periods are three hours in length and run every other week. Updates on the lab format (in-person or online) of the remaining experiments will be announced at a later date.

Rotation 1: ODD numbered practicals (Week 1 students) have their first lab during **week of January 17th.**
Rotation 2: EVEN numbered practicals (Week 2 students) will have their first lab the **week of January 24th.**

Structure of the Synchronous Online Lab Sessions (From January 17th- January 28th)

The synchronous session of the virtual lab will commence 10 min past the hour of the scheduled time for your practical on a Zoom link (the list of Zoom links with PRA section number will be available posted under the lab introductory module). You are encouraged to arrive on time for your assigned session. The synchronous laboratory periods are ***3 Hrs. 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 **first 50 minutes** of each lab period will be spent on discussing theory, procedure, and calculations pertaining to the lab. In the ***second hour of the labs***, the students will be asked to work on their experiment in the virtual lab environment **Ladderane**. While working in the Ladderane virtual lab environment, if students have any questions, the Teaching Assistants (TAs) will be available to help on the Zoom Link during the synchronous lab hours. It is advisable that students open the Ladderane by opening a second browser. This way students can remain logged into the lab Zoom link with their TAs presence while working on the Ladderane platform. The Ladderane virtual environment will be opened to students during the 3.0 Hr synchronous **lab time on the day of the registered practical session**. Students must finish their Ladderane virtual lab during their given time slot to obtain their lab results and record them in their notebook report template. These results will be used to complete the post-lab report sheet.

The last hour of the lab session will be used for Teaching Assistants' office hours. Students are encouraged to attend the office hours to have all their questions pertaining to the virtual labs answered. If they don't have any questions, they can continue completing their Ladderane virtual lab assignment. Students who cannot attend the synchronous TA office hours due to time zone differences are encouraged to post their questions on the lab discussion board for the TAs to be answered during the official contact hours.

Structure of Lab Modules Organization on Quercus

The CHMA10H3 lab content is organized as the following modules on Quercus:

Lab Module 1 introduces the students to the organization of the labs, schedule, Zoom link list for the practical sections, preparation instructions, assignment description, assessment criteria and lab policies.

Lab Module 2 is dedicated to explaining safety policies and practices in first-year undergraduate labs.

Lab Module 3 is designed to introduce ***Ladderane Virtual Lab Platform***, and practice Ladderane experiments for students to try out before their first official Ladderane experiment.

Lab Modules 4-8 will be dedicated to the individual experiments.

Lab Assessment Components

Each experiment module on Quercus has the following Assessment components:

1. **Pre-Lab quiz**: The pre-lab quizzes are released 3 days before the labs and students have two 20 minutes attempts. The pre-lab quizzes have 3 questions, reflecting on the pre-lab reading and questions that students must do before the lab. **Do not wait until the last minute to do your quizzes.**
2. **Ladderane:** Students will complete the Ladderane virtual experiment for the **instructed labs** on the link provided under the respective experimental module. The Ladderane virtual environment will be opened for all students during their 3.0 Hrs. scheduled lab period. Students must finish their Ladderane virtual lab during their lab slot to obtain their results and record them in their notebook report to do the calculations. These results will be used to complete the post-lab report sheet.
3. **Notebook Report**: For the first four experiments students will have 2 weeks to complete their *notebook report template* from the day of their lab session. The last lab notebook report will be due within one week from the day of their last lab session. At the end of the term, the TAs will select one notebook report randomly out of 5 experiments to grade. All documents must be uploaded as a **PDF** file for grading purposes. ***Do not** wait until the last minute to submit your assignments.
4. **Post Lab Report Sheet:** For the first four experiments students will have 2 weeks to complete their Post lab report sheet template from the day of their lab session. The last post-lab report sheet will be due within one week from the day of their last lab session. All documents must be uploaded as a **PDF** file for grading purposes. ***Do not** wait until the last minute to submit.

Laboratory Marking Scheme

The laboratory component is worth 25% of your final grade. The laboratory component is marked out of 100 total marks.

	% Of final grade	Marks
Pre-Lab Quizzes (5 in total)	7.5%	6 marks (x 5)
Post-Lab Report Sheet (5 in total)	12.5%	10 marks (x 5)
Lab Notebook Report (5 in total)	5%	20 Marks
Total Marks:	**25 %**	**100**

*****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 UTSC. Failure to follow safe practices can cause laboratory accidents which may result in personal injury, injury to others, the loss of time, and damage to property. By following suitable precautions, you can anticipate and prevent situations that would otherwise lead to accidents.

Even though, you are not attending the first lab practical in person this academic term, it is mandatory that you understand the safety lab practices applying 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 a PDF copy of your quiz results and upload it into the "WHMIS Results Submission" folder under the Lab Module 2.**

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 other valid reason you must give ahead notice to the Lab Coordinator, Dr. Nirusha Thavarajah (nirusha.thavarajah@utoronto.ca). 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 lab sessions.

Accommodations for Illness or Emergency, Religious Conflicts

For missed lab submissions due to ILLNESS, EMERGENCY, or RELIGIOUS CONFLICTS please complete the following process:

1. Complete the **Request for Missed Term Work Form**
2. **Declare your absence** on ACORN (Profile & Settings > Absence Declaration)

Deadline: You must complete the above forms within **5 business days** of the missed work to be considered as a late submission.
If a post lab assignment is missed and no reasonable explanation or supporting documentation are provided, there is penalty of 10% per day will be applied.

Completion of this form does not guarantee that accommodations will be made. The course instructor reserves the right to decide what accommodations (if any) will be made. Failure to adhere to any aspect of this policy may result in a denial of your request for accommodation.

Students must complete all components of **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, late submission will be considered.
- If a student misses two experimental modules assessments (pre & post), and provides appropriate documentation, late submission will be considered.
- **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.**