CHMA10H3: Introductory Chemistry I
Winter 2023 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!

Instructors

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 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.

- **NOTE**: Second edition is also fine. You will just have to adjust the suggested practice question numbers.

Quercus

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 the 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

Lecture Delivery

Section	Delivery Mode	Time	Days and Location
LEC 01	In-person	11:00-12:00	Mon: HW 214 Wed: MW 160 Fri: HW 214
LEC 02	Online-Asynchronous		Posted on Quercus

Office Hours

Office hours will be offered for 2 hours per week. Some will be in-person while other will be offered via Teams. Exact hours will be announced on Quercus.

Homework

Short online homework problem sets will be released on Quercus at the end of each "module". These are quizzes designed to test your understanding of concepts after we complete each chapter of the textbook. In general, once we complete a chapter during the lectures, you will be given 2 weeks to complete the homework quiz. Keep an eye out for announcements that will clarify details regarding specific deadlines.

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 word limit will be capped at 700 words for the whole essay, which includes your references and title). 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. Below is the breakdown of those marks:

	Weight	Date Due by:
Completion of Quercus module		
Writing Assignment Guidelines	0.5%	February 17 @ 12:00 pm EST
Guided Tour of Essay	0.5%	
Feedback (giving and receiving)	1%	
Web of Science	0.5%	
References	0.5%	
Essay and Feedback		
Draft Essay **NOTE: You MUST submit a draft to be able to complete the feedback.**		**Starts**: January 16 @9:00 am EST **Ends**: February 17 @ 12:00 pm EST
Quality and participation in the peer-feedback process	3%	**Starts**: February 18 @9:00 am EST **Ends**: February 27 @12:00 pm EST
Final essay	9%	**Starts**: February 28 @9:00 am EST **Ends**: March 13 @ 12:00 pm EST
	Total = 15%	

Participation in the Writing Assignment and Late Penalties:

This writing assignment requires you to write a paper and also to provide feedback. Your participation in all aspects of the assignment is very important. You MUST submit a draft of your paper so that others can offer feedback. It does not have to be perfect; it does not have to be finished; it doesn't have to the final product. But you need to submit *something*. If you do not submit a draft of your essay in the initial phase of this assignment, you will not be allowed to participate in the feedback process and you will **LOSE 3% OF YOUR GRADE**.

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

Assessment and Grading Practices:

Graded Work	**Weight (%)**
Homework	5
Writing Assignment	15
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 in-person and 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 in-person and will consist of 20 to 25 multiple choice questions. 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. 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.

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

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	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
6	Chemical Bonding II	10.1-10.2
February 18th-24th	READING WEEK	N/A
8	Chemical Bonding II	10.3-10.8
9	Liquids, Solids, Intermolecular Forces	11.1-11.4
10	Redox Reactions and Stoichiometry	15.6; 4.3-4.5
11	pH, Acids and Bases, Precipitation Reactions,	4.6-4.9
12	pH, Acids and Bases, Precipitation Reactions	4.6-4.9
13	Gas Laws	5.1-5.10
April 11th – 12th	Study Break	
April 13th – 27th	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 know 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 and how these relate to the number of nodes in an atom.
    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.
    vi. Use the Bohr Equation to calculate the energy of electronic transitions in elements.
    vii. Interpret results from the Heisenberg Equation regarding probability

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. **Thermochemistry (Chapter 6):** Students will be able to
    i. Define enthalpy of a reaction.
    ii. Explain the difference between exothermic and endothermic reactions and the sign conventions for each type as related to chemical reactions.
    iii. Perform calculations sing Hess's law to determine ΔHrxn
    iv. Perform calculations with respect to the standard enthalpy change for a reaction.

4. **Chemical Bonding I: Lewis Theory (Chapters 9):** Students will be able to

    i. Distinguish between ionic, covalent and metallic bonding.
    ii. Estimate bond polarity based on electronegativity trends.

iii. Use Born-Haber cycle data to calculate lattice energies for ionic compounds.
iv. Draw Lewis structures for ionic and covalent compounds.
v. Determine formal charges for all atoms in a Lewis structure.
vi. Draw resonance structures for compounds where a single Lewis structure is inadequate.
vii. Rank resonance structures according to their contribution to the overall resonance hybrid.
viii. Make qualitative predictions about bond length/strength.
ix. Estimate reaction enthalpies from bond energy data.

5. **Chemical Bonding II: Molecular Shapes, Valence Bond & Molecular Orbital Theory (Chapter 10):** Students will be able to
   i. Predict the electron group geometry and/or molecular geometry of a molecule using VSEPR theory
   ii. Predict whether a molecule will have a net dipole moment
   iii. Describe the bonding in small molecules using VB theory
   iv. Predict the hybridization of an atom
   v. Distinguish between sigma and pi bonds
   vi. Identify the atomic and/or hybrid orbitals used to make a particular bond
   vii. Distinguish between bonding and anti-bonding MOs
   viii. Draw and interpret MO diagrams for simple diatomics
   ix. Use MO theory to predict properties of diatomic molecules (bond order, bond strength, magnetism)

6. **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.

7. **Chemical Reactions and Stoichiometry (Chapter 4):** Students will be able to
   i) Determine the limiting reagent in a reaction as well as calculating the theoretical and percent yields.
   ii) Determine solution concentrations and dilutions molarity.
   iii) Explain the pH scale and how it relates to water at equilibrium.
   iv) Analyze reactions based on the equilibrium constant with special focus on Ka, Kb and Kw
   v) Recognize and apply the concept of Lewis Acid/Bases Theory
   vi) Recognize and balance different types of chemical reactions including:
      (1) Acid/base
         (a) Identify strong acids and bases and weak acids and bases based on ionization constant

(b) write balanced neutralization reactions and reactions that evolve gases

(2) Precipitation

(a) Predict solubility and write precipitation reactions

(3) Redox

(a) Identify oxidations states and balance redox reaction in both acid and base solution.

8. **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

Laboratory Component of CHMA10

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

The laboratory component of CHMA10 is compulsory. The laboratory periods are three hours in length and run every other week. Odd numbered practicals (Week 1 students) start during week of January 16th. Even numbered practicals (Week 2 students) will have their first lab the week of January 23rd.

Lab Manual and Notebook

A lab manual must be purchased from the UTSC Bookstore before your first lab. You may not use a lab manual from a previous semester: the experiments and course requirements will be different.

DO NOT wait to purchase your lab manual as it contains a host of important information:

- Lab Schedules and other important dates
- Late and absence policies
- Rules regarding safety
- Appropriate attire for the labs
- Guidelines on how to properly prepare for the lab

The bookstore **DOES NOT** stock enough lab manuals for everyone. If they run out, you **MUST** preorder a copy through the bookstore – this takes time. Failure to adhere to the rules and policies outlined within the lab manual will adversely affect your lab mark – in some instances the impact will be severe. In addition, students will be required to purchase their own lab notebook. The book must be hard-cover, permanently bound (not spiral or loose leaf) with the approximate dimensions 8.25" x 10.5" inches. They can be purchased at the UTSC bookstore; however, students are free to purchase their books at a merchant of their choice (so long as they meet the above requirements).

Laboratory Schedule

Week 1 lab students

Students assigned to practical sections ending in **odd numbers** (**i.e., P0001, P0003, P0005, P0007)** have their first lab during the week of January 16th.

Week 2 lab students

Students assigned to practical sections ending in **even numbers, (i.e., P0002, P0004, P0006, P0008)** have their first lab during the week of January 23rd.

Laboratory Schedule:

Week of	Rotation	Experiment
January 16th January 23rd	1 2	EXP 1 – INTRODUCTION TO VOLUMETRIC TECHNIQUES
January 30th February 6th	1 2	EXP 2 – DETERMINING THE ACETIC ACID CONTENT IN VINEGAR
January 30th	1	EXP 3 – MOLECULAR MODELING: LEWIS STRUCTURES AND THE VSEPR MODEL
February 18- 24 Reading Week		
January 27th	2	EXP 3 – MOLECULAR MODELING: LEWIS STRUCTURES AND THE VSEPR MODEL
March 6th March 13th	1 2	EXP 4 – DETERMINATION OF ACID-NEUTRALIZING POWER OF COMMERCIAL ANTACIDS
March 20th March 27th	1 2	EXP 5 – DETERMINATION OF THE UNIVERSAL GAS LAW CONSTANT

Absence from the Laboratory

Accommodations for Illness or Emergency, Religious Conflicts

For missed labs and 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)

If you provide appropriate reasoning for missing your scheduled lab session, you may be eligible to join a make-up lab session, pending available lab space. If you fail to notify the day of your absence you will **NOT** be eligible to request a make-up lab session.

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.

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

Students must attend at least 3 out of the 5 scheduled experiments to be eligible to pass the course.

- If a student misses one experiment, and provides appropriate documentation, they will be considered for a make-up lab for that experiment.

- If a student misses a second experiment, and provides appropriate documentation, they will be considered for a make-up lab for that experiment.
- **If a student misses a third experiment, even if they provide appropriate supporting documentation, they will automatically fail the course.**

If you miss a lab when you are required to hand in material for marking (i.e. Report Sheets), the original report sheet or a scanned copy must be submitted to the Lab Coordinator (Ms. Veronica Cavallari) within 48 hours of the missed lab. Standard late penalties **(i.e. 10% per day up to 5 days – material submitted after 5 days will be assessed a grade of zero**) will be applied to material submitted after the 48 hr. deadline.

Late Policy

1. If you are late to your lab, but the pre-lab discussion is still underway you will be allowed to participate, given than you have complete all the pre-lab work.
2. If you are more than 30 minutes late for your lab you **WILL NOT BE ALLOWED TO PERFORM THE EXPERIMENT AND A MARK OF ZERO WILL BE ASSIGNED FOR ALL OF THE COMPONENTS ASSOCIATED WITH THAT LAB SESSION.**
3. If you show up to the lab without completing your pre-lab work in your notebook, you **WILL NOT BE ALLOWED TO PERFORM THE EXPERIMENT AND A MARK OF ZERO WILL BE ASSIGNED FOR ALL OF THE COMPONENTS ASSOCIATED WITH THAT LAB SESSION.**

Late Penalties

- Report Sheets
    - -10% of the total (not your grade) per day for 5 days (weekends count as two days unless you email a scanned copy of it to the lab coordinator).
    - After 5 days a grade of zero will be assigned
- Notebooks
    - Your notebook will be graded on a regular basis during lab time; your assessment will include prelab preparation and in-lab performance. Refer to pages 10-12 for details on lab notebook preparation and assessments in the lab manual introduction.

Laboratory Marking Scheme

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

Assessment Methods	**% Of final grade**	**Marks**
Quiz (available online 3 days before your lab):	7.5%	6 marks (x 5)
Report Sheets/Graphs/Products:	12.5 %	10 marks (x 5)
Lab Notebooks	5.0%	4 marks (x 5)
Total Marks:	**25 %**	**100**

You must receive a passing grade in the laboratory section in order 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. Students registered in CHMA10H3F will be automatically enrolled in the WHMIS 2022 Training course for the Fall 2022 semester.

Once the course is made available an email announcement will be made and a link to the course will appear in your Quercus home page. As part of this course, students will be expected to watch a couple of videos (approximately 90 minutes long in total) and take a multiple-choice quiz on the material you just learned. Students must obtain 80% on the quiz to pass the WHMIS course. **In addition, students will be required to print off your quiz results and present them to your TA before you will be allowed to enter the lab.**

Safety Equipment

Students will be required to purchase approved indirect vented chemical splash safety goggles, and a lab coat before attending their first lab. These items can be purchased from both the Environmental and Physical Sciences Student Association (EPSA) and the Biology Student Association (BioSA) or through the bookstore. All safety eyewear must meet either ANSI Z87+ or CSA Z94.3 Standard for high impact protection (if you see one of those standards stamped on your eyewear somewhere then they meet that particular standard). As part of your ancillary fees, all CHMA10H3F students will be provided a pair safety glass at their first lab session which can be worn during your quizzes and pre-lab discussion; however, when the experiment begins, students will be required to wear their indirect vented chemical splash goggles.

Labs coats must be 100% cotton – no exceptions.

Further information regarding appropriate attire please see the guidelines outlined in your lab manual.

Note that students not wearing approved safety gear will not be allowed to participate in the lab.