



Advanced General Chemistry (CHMA12H3)
Winter 2023 Syllabus
University of Toronto at Scarborough

Dear Students,

Welcome to advanced general chemistry. We hope that everyone is safe and well, both physically and mentally, as we all cope with the pandemic.

As you've learned and experienced in CHMA10, chemistry is an exciting subject with far-reaching applications in countless disciplines (biology, medicine, geology, environmental science, materials science, food science, neuroscience, forensics—the list goes on!). We will be continuing our discussions around the fundamentals of chemistry and offer applications of these phenomena at play through real-world examples, whether it be the chemistry behind every day products or cutting-edge research led by professors here at DPES.

Below is the syllabus for CHMA12. Please read the course syllabus carefully to understand the learning expectations and assessment methods for this course.

That said, please don't hesitate to reach me via email if you have any concerns or questions as we move through the course together.

Looking forward to the semester ahead,

Marco Zimmer-De Iuliis (**Instructor**) and Lana Mikhaylichenko (**Lab Coordinator**)

EMAIL POLICY/CONTACT INFO:

Marco Zimmer-De Iuliis

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Believe it or not, your time here at UofT will fly by! As part of your training to pursue post-graduate studies or a job/career after your time here at UTSC, we want to ensure you're best prepared to communicate effectively in a professional environment. This includes the emails that we will rely heavily on during these times when practicing physical distancing!

Please use the following guidelines when sending emails:

- i. Use your UofT 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 "CHMA12" 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 48 hours (M-F) provided that the above protocol is used.

REQUIRED TEXTBOOK:

The book will be the same as the one used for CHMA10. You DO NOT need to purchase *Mastering Chemistry*. A second edition book is acceptable. The eBook version is acceptable.

- 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.

ASSESSMENT AND GRADING:

Graded Work	Weight (%)
Homework (quercus)	5
Writing Assignment	15
Term Test #1	7.5
Term Test #2	7.5
Final Exam	35
Lab	30
FINAL MARK	100

To pass the course, you **MUST** pass the laboratory **AND** either have a passing average on both term tests or the final exam (and receive a final grade of 50 or higher). The laboratory component of CHMA12 is **compulsory**.

QUERCUS:

CHMA12 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 CHMA12H3 link.

Official announcements regarding test location and logistics, material covered for each test and other important announcements will be posted on the CHMA12H3 Quercus site. Please check these postings regularly for important announcements.

LECTURES:

Lectures are in-person and are on Mondays, Wednesdays, Fridays from 12:00 pm – 1:00 pm.

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

Not only do we want everyone to be comfortable with communicating through emails, but we also want to support your writing skills in the context of chemistry. 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 your writing skills. You will convey your research and learning on your topic in the form of a peer-reviewed 700-word essay.

Several of you may have completed a similar assignment during CHMA10 in the fall of 2021. For this assignment, the expectations have changed. In CHMA12, we ask that you follow an **analytical approach**. This will be slightly different from what you have experienced in CHMA10, where you wrote a *descriptive style essay*. For an **analytical essay** you will be focusing on one chemistry-related challenge in a topic/field of interest and describing one solution found in recent literature. You will find this style of writing in the introduction or discussion section of peer-reviewed journal articles that you are using to support your essay. Please note you **MUST** submit a draft essay to participate in the feedback process of this assignment. Failure to do so will result in you forfeiting 4% of the overall course grade.

****Please note that the topics in this essay are different from CHMA10 so please do not submit the same essay from CHMA10. It is an academic offense to re-submit work from other courses, so please take this as an opportunity to explore another topic that may be of interest to you. ****

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 online learning modules are available throughout the course and are not for marks but rather are made available for your reference. The assignment will be worth 15% of your final grade. Below is the breakdown of those marks: Below are the due dates and breakdown of those marks:

	Weight	Date Due by:
Completion of Quercus module		
Writing Assignment Guidelines	0	February 17 @ 12:00 pm EST
Guided Tour of Essay	0	
Feedback (giving and receiving)	0	
Web of Science	0	
References	0	
Essay and Feedback		

Draft Essay NOTE: You <u>MUST</u> 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	5%	Starts: February 18 @9:00 am EST Ends: February 27 @12:00 pm EST
Final essay	10%	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 be 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 5% OF YOUR GRADE**.

You can find more details about the writing assignment on the CHMA12 Quercus page.

TERM TEST AND EXAM POLICY:

Term Tests

There will be two 90-minute term tests that count for 15% of your final grade. The tests will include multiple choice, short answer and calculation type questions. Please make sure to check announcements regularly for more information. The exact date, time, and logistics will be announced as soon as this information is made available from the Registrar's office.

Final Exam

There will be a 3-hour, **cumulative** exam written during the end of semester exam period. The exact date, time, and further logistics 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

For on-line format term tests, you may use your textbook only. We trust that you will uphold academic integrity when taking assessments (more details regarding academic integrity below). You may also use non-programmable, non-communicating calculators are allowed for this course.

Policy on Missed Term Tests

Please contact Dr. Zimmer-De Iuliis (m.zimmer.deiuliis@utoronto.ca) to provide notification of your absence and include supporting documentation the required supporting documentation to verify the reason for your absence **within 2 business days of the missed assessment**. At the time of writing this syllabus, absences due to COVID and other medical issues can be self-declared on ACORN. Until the University changes this policy, these self-declarations will be considered acceptable documentation for all medical-related absences. **You must still notify the instructor of the absence!**

If no acceptable documentation is received within 1 week of the term test, you will receive a grade of zero for that test. Please note that in the 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."

CHMA12H3 Lecture Schedule (Tentative*):

Week	Dates	Topic(s)	Suggested Reading
1	Jan 9	No Lecture or Lab	
2	Jan 16	Solutions	12.1—12.8
3	Jan 23	Chemical Equilibrium	14.1—14.8
4	Jan 30	Acids and Bases	15.1—15.6
5	Feb 6	Acids and Bases cont.	15.7—15.11
6	Feb 13	Aqueous Ionic Equilibria	16.1—16.4
7	Feb 20	Reading week	16.5—16.8
8	Feb 27	Aqueous Ionic Equilibria cont.	
9	Mar 6	Gibbs Energy and Thermodynamics	17.1—17.5
10	Mar 13	Gibbs Energy and Thermodynamics cont.	17.6—17.11

11	Mar 20	Electrochemistry	18.1—18.4
12	Mar 27	Electrochemistry / Chemical Kinetics	18.5—18.8,
13	Apr 3	Chemical Kinetics cont.	13.5—13.7
14	April 11	Study Break	
15	April 13	Final Exam Period	

*Although every effort is made to adhere to this schedule, some sections may be longer or shorter.

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. **Solutions Chemistry (Chapter 12):** through this section, we will...
 - i. Discuss the interplay between intermolecular forces (CHMA10) and solubility when preparing solutions
 - ii. Consider the factors that affect solubility
 - iii. Quantify the solubility of gases at different pressures (Henry's Law)
 - iv. Compare the influence of colligative properties on physical properties
 - v. Distinguish the difference between solutions and colloids
2. **Chemical Equilibrium (Chapter 14):** in this section, we will...
 - i. Be introduced to the concept of dynamic equilibrium and learn ways of quantitatively expressing equilibrium
 - ii. Practice applying the equilibrium expressions to quantify the amounts of products and reactants in a reaction
 - iii. Practice predicting the direction in which a reaction will proceed by comparing the reaction quotients with equilibrium constants
 - iv. Discuss how we can predict how a system at equilibrium will respond to disturbances (Le Chatlier's principle)
3. **Acids and bases (Chapter 15):** in this section, we will...
 - i. Define various ways of describing acids and bases (Arrhenius, Bronsted-Lowry, Lewis)
 - ii. Quantify the strength of acids and bases through ionization constants (K_a)
 - iii. Quantify the strength of acids and bases using pH and pOH
 - iv. Relate pH for weak acids and bases with equilibrium constants
 - v. Consider pH and K_a for polyprotic acids
 - vi. Relate the strength of acids to molecular composition and structure
4. **Aqueous Ionic Equilibria (Chapter 16):** in this section, we will...
 - i. Describe how buffers are prepared and understand how they function

- ii. Calculate the pH of buffers using the Henderson-Hasselbalch equation
 - iii. Quantify the effectiveness of buffers
 - iv. Introduce titration and applications with acids and bases
 - v. Practice how titrations can be monitored by calculating the pH during acid base titrations
- 5. Thermodynamics (Chapters 6 and 17):** in this section, we will...
- i. Describe and apply the First, Second, and Third Laws of Thermodynamics
 - ii. Relate heat, work, and energy
 - iii. Discuss enthalpy and application of Hess's Law
 - iv. Introduce entropy, spontaneity, and consider the ways in which energy can be distributed
 - v. Relate entropy and enthalpy
 - vi. Introduce Gibbs energy
 - vii. Differentiate how entropy, enthalpy, and temperature contribute to Gibbs energy (under standard and non-standard conditions)
 - viii. Apply Gibbs energy under equilibrium and non-equilibrium conditions
- 6. Electrochemistry (Chapter 18):** in this section, we will...
- i. Discuss how energy and electricity can be generated from spontaneous chemical reactions
 - ii. Revisit redox reactions and applications in electrochemical cells
 - iii. Practice calculating standard potentials for electrochemical cells
 - iv. Relate spontaneity with cell potentials and predict spontaneous redox reactions
 - v. Relate cell potential to Gibbs energy and equilibrium constant
 - vi. Calculate cell potential under nonspontaneous conditions (Nernst equation)
- 7. Chemical Kinetics (Chapter 13):** in this section, we will...
- i. Quantify reaction rates and relate to concentration of reactants using rate laws
 - ii. Discuss zero, first, and second order reactions and derive integrated rate laws
 - iii. Practice applying rate laws
 - iv. Discuss how reactions can be depicted using energy diagrams and define relevant components
 - v. Analyze kinetic data using Arrhenius plots
 - vi. Discuss the importance of elementary steps and relate to reaction mechanisms
 - vii. Discuss how catalysis relates to kinetics

LABS:

Please note that these are just some of the key details related to the labs this term. Further details will be included in the lab manual that will be posted on Quercus. The laboratory component of CHMA12 is compulsory. **In order to pass the course, you must also pass the lab component.**

Please arrive *on time* for your labs and come *prepared*. The experiments are designed such that a *well-prepared* student can complete the experiment in the allotted time. If you haven't read over the procedure ahead of time and made sure that you understand each step, it will likely be difficult for you to finish your work on time. As a suggestion, we recommend that you prepare a point-form version of the lab procedure before coming to each lab.

Lab Schedule: Please read the Introductory part of your lab manual and check the Quercus Lab Schedule part every week before coming to the lab.

Lab Manual:

Lab Manual for this course will be on sale during your first week of classes. Chemistry Society UTSC (CSU) will be selling them. Please stay tune with all course announcements regarding laboratory course. The introductory part of the Lab Manual has a tentative lab schedule and all the information you need to know about these labs. Please read it before coming to the actual labs.

Lab Coats and Safety Glasses:

Lab coats and safety glasses must be worn at all times in the laboratory. Contact lenses may not be worn in the laboratory. You must bring goggles, a lab coat and a notebook to the labs by yourself. All of these can be purchased from the UTSC Bookstore. You may purchase a lab notebook from the dollar store. The smallest size would be about 6" X 8". The notebook cannot have pages that are easily torn out.

Please make sure your name is in the book as well as on your calculator. *You will not be allowed to work in the laboratory unless you are wearing approved eye protection and a lab coat.*

Absences from the laboratory:

If you need to miss a laboratory period for any valid reason, you must immediately report it to both your TA and to the Lab Instructor, but no later than 48 hours after the lab. If the reason for your absence is medical then you must provide documentation for this. Please fill up a self-declaration form on ACORN and notify Lana. Documentation should be provided as soon as possible so that a makeup lab can be scheduled, provided that room can be found in another lab section. ***If no reason for your absence is made, a mark of zero will be given for that lab.***

Lab quiz:

It will be a short 10 min quiz at the beginning of each lab. Please read a Laboratory Schedule section on a Quercus for more information about each lab.

Lab Website:

All your lab grades for this course and any lab announcements will be on the Quercus course page.

Ancillary fees:

The Department of Physical and Environmental Sciences at UTSC provides state-of-the-art education in chemistry. Chemistry being an experimental science makes learning in a laboratory setting critical. In order to provide the latest technology to enhance the student learning experience, UTSC will be charging ancillary fees for all chemistry courses that have a laboratory component. Those fees are used to recover the cost of materials and services used during the lab and to maintain and upgrade the equipment used by students. To view a complete list of those fees, students are encouraged to visit the following link:

<http://www.planningandbudget.utoronto.ca/Assets/Academic+Operations+Digital+Assets/Planning+Budget/2012-13+Category+5+Ancillary+Fees.pdf>

Laboratory Marking Scheme and Schedule

The laboratory component will be worth 30% of your final grade.

Week #	Laboratory Experiment	Assignment and Marks Affiliated
Jan 9		
Jan 16	Solution Chemistry and Dynamic Chemical Equilibrium	Lab notebook only
Jan 23	Determining the Equilibrium Constant for Bromothymol Blue	Lab notebook only
Jan 30	Is Solubility Related to Periodicity?	10 marks (Data sheet)
Feb 6	Urea Dissolution	10 marks (Data sheet)
Feb 13	Calorimetry and Titration	15 marks (Data sheet)
Feb 20	No labs, reading week	
Feb 27	Measuring the Entropy Change of Cobalt Chloride Complexation	20 marks (Data sheet)
Mar 6	Determining the Amount of Aspartame in a Common Tabletop Sweetener	25 marks (Data sheet)
Mar 13	Solving a Murder Mystery Using Transition Metals and DNA	30 marks (Data sheet)
Mar 20	Culinaria lab – Chemistry at UTSC Kitchen	50 marks (Data sheet)

Mar 27	Caffeine Extraction from Coffee	
Apr 3		
	Quizzes	10x10=100
	Notebooks	50
	Lab Performance	50
	Total	410

You must complete the laboratory section with a passing grade in order to pass the course.

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, the classroom or course materials, please contact us and or the Accessibility Services as soon as possible: (416) 287-7560 or ability@utsc.utoronto.ca

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: <http://www.artsci.utoronto.ca/osai/students> 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.