Advanced General Chemistry (CHMA12H3)
Summer 2020 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 this course. 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:

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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 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.

ASSESSMENT AND GRADING:

It has recently been decided that the campus will remain closed for the whole duration of the summer semester. This means that all components (lectures, labs, and tutorials) will all be hosted online.

Graded Work	Weight (%)
Clutch Prep Assignments	5
Writing Assignment	12
Chemdraw Assignment	3
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:

- Mondays and Wednesdays from 10:00 am – 12:00 pm.

As we engage in online/distance learning, it can be helpful to have a sense of rhythm and structure to our days. Lectures will be pre-recorded and posted twice a week at the aforementioned times. We're still working to find the most reliable and suitable mode of recording lectures. At the moment, they will likely be screen capture recordings that will be uploaded onto Quercus. That said, we may try experimenting with other software to streamline the delivery of lectures as the semester progresses, but we will ensure to keep everyone posted.

OFFICE HOURS:

Office hours will be offered for 3 hours per week on Teams. Exact hours will be announced on Quercus.

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 500-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 12% of your final grade. Below are the due dates and breakdown of those marks:

January 17 @ 9:00 am EST – April 5th @ 9:00 am EST	Online modules available for your reference
January 17 @ 9:00 am EST – February 14 @ 2:00 pm EST	Draft Essay Submission is Available
February 14 @ 2:00 pm EST	Deadline (DUE DATE) for submitting first draft of your essay (on peerScholar) NOTE: You **MUST** submit a draft to be able to complete the peer feedback component.
February 16 - 23	Time for providing peer feedback
February 28 @ 2:00 PM EST	Deadline (DUE DATE) for submitting peer feedback (on peerScholar)
March 2 @ 9:00 EST – March 9	Revise essay
March 9 @ 2:00 PM EST)	Deadline (DUE DATE) for submitting final draft of your essay (on peerScholar and Ouriginal)

Essay and Feedback	**Weight (%)**
Final essay	8
Quality and participation in the peer-feedback process	4
	Total = 12%

You can find more details about the writing assignment on the CHMA11 Quercus page.

TERM TEST AND EXAM POLICY:

Term Tests

There will be two 90-minute term tests.

I. The first test will be delivered on-line via Quercus Quizzes. It will a mix of multiple choice, numerical answers, and multiple answers.

II. The second term test is planned to be in-person; however, due to COVID circumstances, this could change. This test is planned to have 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."

Homework through Clutch Prep

Throughout the course, you will be assigned a set of questions through the Clutch Prep platform. Clutch Prep includes video lessons and video homework assignments. These problems are intended to help you practice the skills and concepts taught during lecture.

To sign up for our class and register your account, go to https://www.clutchprep.com/join/TORONTO2. Our class code is: TORONTO2. Then follow the prompts to enter your name, email address, and create a password. Guidelines for registering can also be found on the CHMA12 Quercus page. **For technical support, please DO NOT contact Marco Zimmer-De Iuliis Lana Mikhaylichenko.** You should contact Clutch directly. These assignments are worth 5% of your final grade.

What are Clutch Prep Video Homework Assignments?

- Clutch Prep makes textbook-specific video-based concept and practice content for this course.
- Our class will also be using **Clutch Prep homework assignments** for graded homework. Every question on your homework assignments comes with a video solution.

Clutch Prep Technical Difficulties or Account Questions: If you run into any technical issues or have questions about your Clutch Prep account, message the Clutch Prep Customer Service using the blue help chat button in the bottom right corner of the screen. This will be the fastest and most effective way to resolve your issues.

The help button looks like this:

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.**

At the time writing this syllabus, until January 31, 2022 UTSC will be offering all aspects of delivery of via online methods. This includes labs and lectures. Please keep up-to-date with course announcements for more information if (or when) in-person teaching and labs will resume.

Lab Manual and Notebook:

You **DO NOT** need to purchase a lab manual, it will be made available to you through Quercus. You **DO** need a lab notebook to keep record of all your virtual experiment. It is important that you continue to build effective note keeping habits through these times as you will be expected to know how to prepare and manage your experimental results in a lab notebook in future courses. Further details as to how to prepare your notebook will be made available in the lab manual posted on Quercus.

Please check the lab manual for more details.

Laboratory Marking Scheme and Schedule

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

Week #	Laboratory Experiment	Assignment and Marks Affiliated
Jan 10		
Jan 17	Solution Chemistry and Dynamic Chemical Equilibrium	Lab notebook only
Jan 24	Determining the Equilibrium Constant for Bromothymol Blue	Lab notebook only
Jan 31	Is Solubility Related to Periodicity?	10 marks (Data sheet)
Feb 7	Urea Dissolution	10 marks (Data sheet)
Feb 14	Calorimetry and Titration	15 marks (Data sheet)
Feb 21	No labs, reading week	

Feb 28	Measuring the Entropy Change of Cobalt Chloride Complexation	20 marks (Data sheet)
Mar 7	Determining the Amount of Aspartame in a Common Tabletop Sweetener	25 marks (Data sheet)
Mar 14	Solving a Murder Mystery Using Transition Metals and DNA	30 marks (Data sheet)
Mar 21	The Synthesis and Analysis of Aspirin	50 marks (Formal Lab report)
Mar 28		
Apr 4	Lab Literature Assignment	50 marks
	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.

Missed labs

If you miss any course work for a legitimate reason, you must email Dr. Mikhaylichenko as soon as possible. Supporting documentation will be required to verify the reason for your absence. 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.

If you miss the deadline for submitting any of the lab related documents that are graded, the grade for the missed deadline will be redistributed over the other labs once appropriate documentation has been received. There are **NO** make-up labs. In the case you find yourself in a position where you are having technical issues with uploading your documents onto Quercus, immediately email Dr. Mikhaylichenko and attach your document that you want to submit so that you are not penalized for submitting late work. You will still have to submit your documents onto Quercus once issues are resolved.

If no documentation is provided, mark deductions will be applied (further details in the lab manual).

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.

CHMA12H3 Lecture Schedule (Tentative*):

Week	Dates	Topic(s)	Suggested Reading
1	Jan 10	**No Lecture or Lab**	
2	Jan 17	Solutions	12.1—12.8
3	Jan 24	Chemical Equilibrium	14.1—14.8
4	Jan 31	Acids and Bases	15.1—15.6
5	Feb 7	Acids and Bases cont.	15.7—15.11
6	Feb 14	Aqueous Ionic Equilibria	16.1—16.4
7	Feb 21	Aqueous Ionic Equilibria cont.	16.5—16.8
8	Feb 28	Reading week	
9	Mar 7	Gibbs Energy and Thermodynamics	17.1—17.5
10	Mar 14	Gibbs Energy and Thermodynamics cont.	17.6—17.11
11	Mar 21	Electrochemistry	18.1—18.4
12	Mar 28	Electrochemistry / Chemical Kinetics	18.5—18.8,
13	Apr 4	Chemical Kinetics cont.	13.5—13.7
14	April 11	**Study Break**	
15	April 18	**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