



## Introductory Chemistry II (CHMA11H3) Summer 2018 University of Toronto at Scarborough

Dear Students:

Welcome to Introductory Chemistry Part II! My 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. I am looking forward to teaching you many interesting topics, including inter molecular forces, covalent and ionic bonds, chemical kinetics, catalysis, chemical equilibrium, entropy, free energy and electrochemistry. Please read through the course syllabus to understand the learning expectations and assessment methods. Looking forward to meeting all of you!

***Course Instructor and Lab Coordinator:***

Dr. Nirusha Thavarajah

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Office Hours: Mondays 12:00-1:30 pm and Wednesdays 10:30 am-12:00 pm at ESCB 544

***Email Policy:***

- Use UTSC 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.
- Put CHMA11 in the subject line followed by the reason for the email.
- Use professional language with a formal greeting.
- Sign the email with your first and last name. Include your student ID number after your name.
- Every effort will be made to respond to student emails within 36 hours (M-F) provided that the above protocol is used.

***Required Text Book:*** Chemistry: A Molecular Approach, 2nd Canadian Edition, by Nivaldo J. Tro, Travis D. Fridgen, Lawton E. Shaw, Pearson Canada Inc.

***Lectures:*** Mondays 2:00-4:00 pm and Thursdays 10:00 am-12:00 pm at SW319. I strongly encourage all of you to attend all the lectures to engage in the participatory lessons! Lecture casting of each lecture will be available for only four days from the day of the lecture.

***Website:*** CHMA11H3 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 CHMA11 link.

***Announcements:*** Official announcements regarding test locations, material covered for each test and other important announcements will be posted on the CHMA11H3 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, the classroom 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](mailto:ability@utsc.utoronto.ca)

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

**Grade Calculation:**

Graded Work	Weight (%)
Laboratory	25
Mastering Chemistry Assignments	5
Mid-Term Test	30
Final Exam	40

**\*\* Course Policy:** To pass the course, you ***must pass the laboratory*** and either the term test or the final exam and receive a final grade of 50+, of course!

**\*\* Bonus (2%):** Developing 1 concept map (1%) on one of the modules and finding one reliable resource on real life application (1%) relevant to any of the concepts covered in class. More details on the bonus assignments will be posted on Quercus.

**\*\* Bonus (1%):** Active participation in-class via Peer-instructions on learning catalytic. Must participate and contribute on a regular basis in-class.

**Midterm and Exam Policy:**

**Midterm:** There will be 90 minutes mid-term test written outside of class either just before or just after the Reading Week. The exact date, time and location will be announced as soon as they are available. If you miss the midterm due to legitimate reasons, you must submit the official supporting document within one week of your absence to be considered to write the make-up test. If the reason is medical, an official UTSC medical form should be downloaded from the Registrar's website:

[http://www.utsc.utoronto.ca/~registrar/resources/pdf\\_general/UTSCmedicalcertificate.pdf](http://www.utsc.utoronto.ca/~registrar/resources/pdf_general/UTSCmedicalcertificate.pdf), completed and signed by your physician. **If no acceptable documentation is received, you will receive a zero for that test.**

**Final Exam:** There will be a 3-hour, cumulative exam written during the end of semester exam period. The exact date, time and location 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 Aid:** Only non-programmable, non-communicating calculators are allowed in tests and exams for this course (both lecture and lab). Students **must** bring their own calculators.

**Laboratory:**

The laboratory component of CHMA11 is compulsory. In order to pass the course, you must also pass the lab component.

**Lab Schedule:**

Laboratory periods are three hours in length and run every other week. Laboratory Section Schedule:

**Week 1 lab students:** Students assigned to practical sections ending in odd numbers, P0001, P0003, P0005, P0007 have their first lab on May 16th.

**Week 2 lab students:** Students assigned to practical sections ending in even numbers, P0002, P0004, P0006, P0008 have their first lab on May 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
- Marking schemes
- 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** pre-order 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). **Students are allowed to reuse their lab notebook from previous courses** (*just make sure that your table contents reflects the fact that the book contains material from multiple courses*).

**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 CHMA11H3S will be automatically enrolled into the course which should appear in your “My Courses” window of your blackboard home page.

As part of this course, students will be expected to watch a video (approximately 30 minutes long) and take a multiple choice quiz on the material you just learned (**the quiz is different than the previous term**). Students must obtain 80% on the quiz to pass the WHMIS course. **In addition, students will be required to print off their 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 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).

**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.**

***Ancillary Fees***

Students taking CHMA11 will be assessed a \$25.00 ancillary fee which will cover the cost of chemicals, filter paper, Pasteur pipettes and other items consumed over the course of the lab. For more information regarding ancillary fees students are encouraged to visit the following website:

<http://www.planningandbudget.utoronto.ca/tuition.htm>

***Absence:*** If you miss a significant period of class work through illness or a related reason, you should request consideration by submitting a completed University of Toronto Student Medical Certificate which is available on the following web site:

([http://www.utscc.utoronto.ca/~registrar/resources/pdf\\_general/UTSCmedicalcertificate.pdf](http://www.utscc.utoronto.ca/~registrar/resources/pdf_general/UTSCmedicalcertificate.pdf)).

The document must be presented within one week of the date of absence. However, you should notify the course instructors the day of your absence (see your lab manual regarding absences from the lab). Only serious illness (or equivalent reasons) will be accepted as justification for absence (note: the U of T Medical Certificate, filled out by your doctor, stating that you saw him/her on a given day is not adequate. Your doctor must certify that *you were too sick to attend the test*, etc.). The form of consideration extended for a particular item of missed term work will be explained to you when you submit the certificate.

***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.

According to Section B of the University of Toronto's Code of Behavior 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.

**CHMA11H3 Lecture Schedule (\*Tentative)**

<i>Week</i>	<i>Topic(s)</i>	<i>Suggested Reading</i>
<i>1</i>	<i>Dynamic Chemical Equilibrium</i>	<i>14.1-14.3</i>
<i>2</i>	<i>Dynamic Chemical Equilibrium</i>	<i>14.4-14.8</i>
<i>3</i>	<i>Acid-Base Equilibria in Aqueous Solution</i>	<i>15.1-15.6</i>
<i>4</i>	<i>Acid-Base Equilibria in Aqueous Solution Cont.</i>	<i>15.7-15.11</i>
<i>5</i>	<i>Aqueous Ionic Equilibria</i>	<i>16.1-16.4</i>
<i>6</i>	<i>Aqueous Ionic Equilibria cont.</i>	<i>16.5-16.8</i>
<i>June 19<sup>th</sup>-23<sup>rd</sup></i>	<i>READING WEEK</i>	<i>N/A</i>
<i>7</i>	<i>Gibbs Energy and Thermodynamics</i>	<i>17.1-17.4</i>
<i>8</i>	<i>Gibbs Energy and Thermodynamics Cont.</i>	<i>17.5-17.9</i>
<i>9</i>	<i>Electrochemistry</i>	<i>18.1-18.4</i>
<i>10</i>	<i>Electrochemistry cont.</i>	<i>18.5-18.8</i>
<i>11</i>	<i>Chemical Kinetics</i>	<i>13.1-13.4</i>
<i>Week 12</i>	<i>Chemical Kinetics cont.</i>	<i>13.5-13.7</i>
<i>August 8<sup>th</sup> – 10<sup>th</sup></i>	<i>Study Break</i>	
<i>August 11<sup>th</sup> -24<sup>th</sup></i>	<i>Final Exam Period</i>	

*University Closures: Monday May 21<sup>st</sup> (Victoria Day), Monday, July 2<sup>nd</sup> (Canada Day), Monday August 6<sup>th</sup> (Civic Holiday).*

***Lecture Topics and Learning Outcomes:******Topic 1: Dynamic Chemical Equilibrium (Chapter 14)***

- 1) Students will acquire a deeper understanding on the concept of dynamic equilibrium.
- 2) Students will be able write equilibrium constant expressions and calculate equilibrium constants from given quantities.
- 3) Students will be able to calculate equilibrium amounts of reactants and products with a known equilibrium constant.
- 4) Students will understand the concept of reaction quotient and will be able to predict the direction of change.
- 5) Students will be able to predict how a system at equilibrium responds to disturbances (Le Chatelier's principle)

***Topic 2: Acid-Base Equilibria in Aqueous Solution (Chapter 15)***

- 1) Students will learn the definitions of acids and bases.
- 2) Students will understand the concept of acid strength and ionization constant ( $K_a$ ).
- 3) Students will understand autoionization of water and the ion product constant for water ( $K_w$ ).
- 4) Students will learn to calculate the pH of strong acid.
- 5) Students will be able to calculate pH for weak acids and calculate equilibrium constant based on pH.
- 6) Students will be able to find the percent ionization of a weak acid.
- 7) Student will be able to calculate the pOH of a strong and weak base solution.
- 8) Students will understand and apply the acid-base properties of ions and salts.
- 9) Students will be able to calculate the pH of a polyprotic acid solution.
- 10) Students will understand the relationship between strength of acids and bases and molecular structure.

***Topic 3: Aqueous Ionic Equilibria (Chapter 16)***

- 1) Students will understand the definition of buffers.
- 2) Students will learn to calculate the pH of buffers using Henderson-Hasselbalh equation.
- 3) Students will learn to predict the effectiveness of a buffer by learning about buffer range and buffer capacity.
- 4) Students will learn the titration pH curves for the following: i) strong acid with a strong base, ii) weak acid with a strong base and iii) weak base with a strong acid.
- 5) Students will understand solubility equilibria and solubility product constant ( $K_{sp}$ ).
- 6) Students will understand the effect of common ion, uncommon ion, complex-ion equilibria and pH on solubility.
- 7) Students will be able to predict precipitation of reactions by comparing reaction quotient (Q) and Solubility product constant ( $K_{sp}$ ).
- 8) Students will learn about the applications of qualitative chemical analysis.

*Topic 4: Gibbs Energy and Thermodynamics (Chapter 17)*

- 1) Students will develop an understanding for spontaneous and nonspontaneous process and the application of second law of thermodynamics.
- 2) Students will learn to predict entropy change and calculate entropy of the surroundings.
- 3) Students will understand the effect of changes in enthalpy, entropy and Gibbs energy on spontaneity.
- 4) Students will learn to estimate the change in Gibbs energy for a reaction under standard and nonstandard conditions.
- 5) Students will understand the relationship between Gibbs Energy and equilibrium constant.
- 6) Students will learn about the temperature dependence of the equilibrium constant and use the two-point form of the Van't Hoff equation to predict the equilibrium constant at a given temperature.

*Topic 5: Electrochemistry (Chapter 18)*

- 1) Students will learn about generating electricity from spontaneous chemical reactions.
- 2) Students will learn to calculate standard potentials for electrochemical cells from standard electrode potentials.
- 3) Students will learn to predict spontaneous redox reactions.
- 4) Students will understand the relationship between cell potential, Gibbs energy and the equilibrium constant.
- 5) Students will learn to calculate cell potential under nonstandard conditions.
- 6) Students will gather knowledge on different types of voltaic cells.
- 7) Students will develop an understanding for driving nonspontaneous chemical reactions with electricity and its application in real life.
- 8) Students will understand the concept of corrosion, an undesirable redox reaction.

*Topic 6: Chemical Kinetics (Chapter 13)*

- 1) Students will understand the concept of rate of a chemical reaction.
- 2) Students will learn to express rate law and determine the order and rate constant of a reaction.
- 3) Students will understand the effect of concentration and temperature on reaction rate.
- 4) Students will be able to propose reaction mechanisms based on chemical kinetics.