Chemistry
UNIVERSITY OF TORONTO

CHM220H1F: Physical Chemistry for Life Sciences

Summer 2025 Course Syllabus

I. CONTACTS

INSTRUCTOR and COURSE COORDINATOR
Name: Dr. Mima Staikova
Email: mima.staikova@utoronto.ca

Teaching Assistants:

Names:	Aries Delica	Jiaqi Gong
Emails:	aries.delica@mail.utoronto.ca	jiaqi.gong@mail.utoronto.ca

II. COURSE OVERVIEW

COURSE DESCRIPTION:
A central theme of CHM 220H is that, starting from a few basic physical principles, it is possible to understand phenomena ranging from the small-scale behavior of single molecules to complex biological processes. One of the goals of the course is to give you an introduction to this remarkable relationship between physical chemistry concepts and observations. CHM 220H will cover key concepts in modern physical chemistry and biophysics. It will prepare you for 300-level life science classes or will serve as an introductory course for physical chemistry. Problems will involve calculations and some mathematical concepts, as well as qualitative topics. It is important both to understand the ideas presented from a conceptual point of view, and to be able to use them to solve quantitative problems.

STUDENT LEARNING OUTCOMES:
By the end of this course, students will be able to:

- apply central concepts in physical chemistry (e.g. entropy, Gibbs energy) to the description of biochemical systems.
- formulate scientific questions about biochemical systems in quantitative terms.
- plan ways to calculate answers to questions.
- calculate and interpret answers to the questions.
- communicate results, and conclusions using appropriate SI units, language, and formats.

Physical chemistry is a problem-solving discipline: therefore, you must be able to apply concepts taught in classes to solve new problems. Note that tutorials will provide very useful examples of problems that you should be able to solve on quizzes and tests and provide an excellent opportunity to ask questions. It is, therefore, highly recommended that you take advantage of this resource.

PREREQUISITE COURSE(S):
This course requires that you have a fundamental understanding of introductory chemistry (CHM 135H, CHM 136/CHM151). In addition, you are required to have taken a course in differential and integral calculus: (MAT 135H, 136H)/137Y/157Y. MAT 235Y/237Y is a recommended co-requisite course.

TEXTBOOKS:
For the thermodynamics section (TMOL): we will use "The Molecules of Life", by Kuriyan, Konforti, & Wemmer
This is available from the U of T Bookstore:
https://uoftbookstore.com/buy_book_detail.asp?pf_id=14646522
Alternatively, the Amazon link can be used:
https://www.amazon.ca/Molecules-Life-John-Kuriyan/dp/0815341881
For the Quantum Mechanics section (QM): reference text will be "Physical Chemistry for the Chemical and Biological Sciences", by Raymond Chang. *Only selected chapters from this text will be used. Photocopies of the relevant chapters 11-15 will be offered through the Chemistry Library on Quercus*.

ED DISCUSSION BOARD
This term we will be using Ed Discussion Board for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and the instructor. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Ed Discussion Board.
Note that sharing solutions of any sort of graded course work before deadlines on the discussion board is in violation of University of Toronto's Code of Behaviour on Academic Matters (see Academic Integrity section of syllabus.)

III. COURSE ORGANIZATION

CHM220, Summer semester 2025, is scheduled fully online.
Please, note that all times for scheduled course activities are given in EST.

There are two components to this course, *Lectures and Tutorials*. Each student needs to be registered on ROSY for both**.** The materials for both components will be posted on the same Quercus shell, on the corresponding pages. Over the course of each week, students are expected to participate in online classes/tutorials, watch posted lecture video recordings and read the corresponding sections of the textbooks according to the course schedule. Zoom will be used for the online meetings. There will be a separate links for the Lectures and the Tutorials. Further, students need to follow all relevant instructions, announcements, and perform their course work within the specified time frames and due dates.

The classes will run between May 5th and June 16th, 2025. The final examination will be scheduled during the exam period, June 19-24th.

LECTURES

The first lecture, an introduction, will take place *live online* on Monday, May 5th, 2025 at 15:00. The lecture delivery during the duration of the course will be done both, in synchronous and asynchronous mode. Relevant information will be posted in advance of the lectures. Video recordings will be posted after the synchronous lectures. For the asynchronously delivered lectures the recordings will be posted weekly.

The Lecture hours are:

Monday 15:00 — 17:00
Tuesday 15:00 — 17:00
Thursday 15:00 — 17:00

TUTORIALS

There are a total of *11 tutorial synchronous meetings*, two tutorial sessions a week:

Mondays and Thursdays, 1-2 pm.

All tutorials will be delivered synchronously. **The first tutorial is on Thursday, May 8th**. The information relevant for the tutorials, including the zoom meeting links and the tutorial quizzes, will be posted on *the Virtual Tutorials page.*

TUTORIAL OBJECTIVES:

Tutorials are designed to give you practice at applying concepts learned during lectures for solving quantitative problems related to understanding biochemical systems. Problem sets for each tutorial will be based on the concepts/topics covered in lectures during the preceding week and will be posted ahead of time.

You should try to solve the problems before coming to the corresponding synchronous tutorial session. At the tutorial, your teaching assistant will address your questions on the posted problem sets, show how to work them and provide further reinforcement of concepts learned.

QUIZZES:

There will be a total of **3 online quizzes**, available for 30 min between 8 am – 8 pm on selected Fridays. The quizzes are designed to test whether you have achieved the learning objectives for the indicated lecture material. *All 3 quizzes count towards your final grade.*

EXAMINATIONS

All examinations will be done online.

To assess your knowledge of the TMOL and QM material, there will be a total of two term tests and one QM assignment report. The two tests will be available for 50 min on selected Monday/Tuesday time slots, from 6 pm on Monday until 6 am on Tuesday. The timing aims to accommodate students that might be in different time zones than

Toronto.
In addition, there will be a **cumulative test** (TMOL and QM material) at the end of the class time in June. Details on the last test will become available in due course.

QM ASSIGNMENT
A Computational project based on the QM material will be assigned to all students, and the report for it is part of the final course grade. It will be introduced on **June 3th** during tutorial/lecture time. After the introduction the students will perform quantum mechanical calculations on specified compounds on their own time on the UofT computational server, using a browser interface, WebMO. Each student will have a designated directory with their own user id and password. *It is required that the calculations are performed, and all data are collected only in the student's own directory on this server*. After the calculations are finished, each student will write a report using and interpreting the calculated data, incorporating the QM lecture material.
The project and the associated report will be in lieu of Term Test 3 grade.

The Computational project includes the following components:

- performing calculations using the web based UofT WebMO interface on the specific topic **in the period between June 2 – June 9.** Deadline for finishing the WebMO calculations June 9th. There will be *a 10% penalty per day from your report grade for exceeding the calculation time period.*
- evaluating the data from your WebMO calculation.
- writing a report - **due on June 16th -** *10% penalty per day for late submission*

The assignment description will become available by latest on June 2nd.
This assignment is to be completed independently. Help will be available at office hours and during some TA sessions.

IV. EVALUATION/GRADING SCHEME

There will be four assessment components in the Grading Scheme:

I. *Three Quizzes*: worth total of 15%*
Each quiz will be multiple-choice in nature.

II. *Two Midterm Tests*: total worth 40%**

III. *Quantum Mechanics Assignment:* worth 20%:

IV. Cumulative Test: worth 25%; details TBA

*note *No make-up quizzes can be offered*.
If missing **one** quiz for valid reason (you have done the other two), the third quiz grade will be assigned as average of the written ones.

If more than one quiz is missed for valid reason, an extra cumulative quiz will be required at the end of the semester, the grade of which will replace the grades of the missing quizzes.

**note: *No make-up term tests can be offered.*
If missing **one** term test for a valid reason, the missed test grade will be calculated based on performance on the other term test and the class average of the tests.
If both term tests are missed for valid reasons the marks for the missing tests will be replaced by the mark of the last, cumulative test.

POTENTIAL NETWORK DISRUPTIONS DURING ONLINE ASSESNENTS:

- If network disruption occurs at your end, don't panic! Please, contact the course coordinator with details of the situation - how long you had been writing the Quiz/Test for and at what time the disruption occurred. Please note that you may not receive a response until after your assignment window closes. Stay calm – we will get back to you.
- if an unexpected technical issue occurs with a university system (e.g., Quercus services, network outage) that affects availability or functionality, it may be necessary to revise the timing or weighting of the quizzes/term tests.

V. COURSE POLICIES

- Each member of this course is *expected to maintain* a:

(i) professional and respectful attitude during all course activities, including classes, tutorials and online activity.
(ii) *personal calendar/schedule/organizer* to ensure that all course activities are completed, and due dates are met.
(iii) collection of notes recorded independently based on concepts covered in course activities (students registered with Accessibility Services requiring a class note-taker will have access to this accommodation)
(iv) familiarity with the university policy on Academic Integrity (overleaf)

- The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. As a Course Instructor, I will neither condone nor tolerate behaviour that undermines the dignity or self-esteem of any individual in this course and wish to be alerted to any attempt to create an intimidating or hostile environment. It is our collective responsibility to create a space that is inclusive and welcomes discussion. Discrimination, harassment and hate speech will not be tolerated. If you have any questions,

comments, or concerns, we encourage you to reach out to the staff in our Equity Offices.

- **Absence/missed class work.**

  If you were unable to complete graded course work due to illness or other reasons, then a piece of written documentation is required. The following four items are the recognized forms of documentation:

  1. Absence Declaration via ACORN (please note the Acorn absence declaration can be used for health conditions, personal or family emergencies, or bereavement and can only be used once per semester for a maximum of seven consecutive days – see website for full details)
  2. U of T Verification of Illness or Injury Form
  3. College Registrar's letter
  4. Letter of Academic Accommodation from Accessibility Services

  After obtaining the written documentation, students must additionally contact the course instructor within 1 week of the missed work for any consideration to be granted.
  For extended absences and for absences due to non-medical reasons, make sure to contact your College Registrar's Office. They can help you decide between a request for an extension or other types of academic consideration, as well as help you access resources as needed.
  If you suspect or know that you have a disability that is affecting your studies, learn about the services and supports available through Accessibility Services. A disability can be physical disability, sensory disability, a learning disability, mental health disorder or a short-term disability like an injury. If you are not sure whether you have a disability, you can confidentially contact Accessibility Services with your questions.

- **Communication with instructor, TAs:**
  We strive to answer your emails within 24 hours during weekdays.
  Please, note your email will only be accepted if:
  1. You send it from your utoronto.ca account.
  2. You identify yourself as a student in CHM 220 and *include your name, and student id number.*
  3. No attachments or screenshots are sent.
  4. As you are aware that chemistry can be discussed during office hours much more effectively than by email, students are encouraged to seek help and advice on content questions during office hours and by posting questions on Ed Discussion.
  Please, reserve email communication for administrative issues and for making appointments with instructors - *detailed course material questions*

will not be answered. Scheduled instructor *virtual* office hours will be posted on the web page - alternative hours will be available by arrangement.

- This course, including your participation, will be recorded on video and will be available to students in the course for viewing remotely and after each session*. Course videos and materials belong to your instructor, the University, and/or other source depending on the specific facts of each situation and are protected by copyright.* In this course, you are permitted to download session videos and materials for your own academic use, but you should not copy, share, or use them for any other purpose without the explicit permission of the instructor. For questions about recording and use of videos in which you appear please contact your instructor.

VI. TECHNOLOGY REQUIREMENTS

- Specific guidance from the U of T Vice-Provost, Students regarding student technology requirements is available here: https://www.viceprovoststudents.utoronto.ca/covid-19/tech-requirements-online-learning/

- Advice for students more broadly regarding online learning is available here: https://onlinelearning.utoronto.ca/getting-ready-for-online/
- This course requires the use of computers, and technical issues are possible. When working on a piece of academic work, students are responsible for scheduling enough time to allow for reasonable delays due to technical difficulties to be overcome, so such issues will not be acceptable grounds for deadline extension. Particularly, maintaining an up-to-date independent backup copy of your work is strongly recommended to guard against hard-drive failures, corrupted files, lost computers, etc. We encourage you to spend a moment at the start of the semester to make a plan for what you would do if you lost access to the computer that you primarily intend to use, which will help ensure that you are prepared for this unlikely possibility.

VII. INSTITUTIONAL POLICIES & SUPPORT

ACADEMIC INTEGRITY

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result*, the University treats cases of cheating and plagiarism very seriously*. The University of Toronto's Code of Behaviour on Academic Matters is published and can be found in the link below:
governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

In assignments:

1. Using someone else's ideas or words without appropriate acknowledgement.
2. Submitting your own work in more than one course without the permission of the instructor.
3. Making up sources or facts.
4. Obtaining or providing unauthorized assistance on any assignment.

On tests and quizzes:

1. Using or possessing unauthorized aids.
2. Looking at someone else's answers during an exam or test.
3. Misrepresenting your identity.

In academic work:

1. Falsifying institutional documents or grades.
2. Falsifying or altering any documentation required by the University.

For all graded work:

Please note that the use of ChatGPT or any other form of generative artificial intelligence tool for graded work is strictly forbidden. Use of such a tool amounts to employing an unauthorized aid under the University Code of Behaviour on Academic Matters. If a student is found to have used such a tool during tests/quizzes, a meeting with the student will be arranged as the first step of the process defined under the Code.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behavior or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources:

see www.academicintegrity.utoronto.ca/

COPYRIGHT

If a student wishes to copy or reproduce class presentations, course notes or other similar materials provided by instructors, he or she must obtain the instructor's written consent beforehand. Otherwise, all such reproduction is an infringement of copyright and is absolutely prohibited. More information regarding this is available here: https://teaching.utoronto.ca/ed-tech/audio-video/copyright-considerations/

ACCESSIBILITY NEEDS

Students with diverse learning styles and needs are welcome in this course. The University of Toronto is committed to accessibility: if you require accommodations for a disability, or have any other accessibility concerns about the course, please contact Accessibility Services as soon as possible.

ACCOMMODATIONS FOR RELIGIOUS OBSERVANCES

Following the University's policies, reasonable accommodations will be made for students who observe religious holy days that coincide with the due date/time of an

assignment, tutorial, class or laboratory session. Students must inform the instructor **before** the session/assignment date to arrange accommodations.

ADDITIONAL SERVICES & SUPPORT

The following are some important links to help you with academic and/or technical service and support:

- General student services and resources at Student Life
- Full library service through University of Toronto Libraries
- Resources on conducting online research through University Libraries Research
- Resources on academic support from the Academic Success Centre
- Learner support at the Writing Centre
- Information for Technical Support/Quercus Support

ACKNOWLEDGEMENT OF TRADITIONAL LANDS

We wish to acknowledge this land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca and, most recently, the Mississauga of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.