

CHMB21H3S, Chemical Structure and Spectroscopy

Instructor: Prof. Alex Voznyy o.voznyy@utoronto.ca

TA: Zhibo Wang (homework grading)

Timbila Magobenny (labs)

Slack channel: <https://join.slack.com/t/chmb21/signup> (Links to an external site.) (only @mail.utoronto.ca emails are automatically accepted)

Web: CHMB21 maintains a Quercus web space that archives a variety of course-related information including grades, class announcements, PowerPoint lecture presentations, video content, lab materials, contact information, and links to outside resources.

Lectures: Synchronous, on Zoom

Monday 15:00–17:00,

Wednesday 15:00–16:00

Office hours: **Wednesday 10 am** or any other day *by appointment*. Questions are welcome at any time through public or private messages on Slack.

<https://utoronto.zoom.us/j/88173802643> (Links to an external site.) Meeting ID: 881 7380 2643 Passcode: 504820

Labs: Will start **AFTER** the reading week Mondays 13:00–15:00

Marking Scheme: Homeworks **20%**, Midterm Exam **30%**, Final Exam **35%**, Labs **15%**.

A bell curve will be used for marking the exams.

For each day of **delay** on homework and lab reports you will receive a **20% penalty**. Nevertheless, it is always better to return your reports late rather than not return them at all.

To pass this course you need to **pass (50+) either the midterm test or the final exam, AND** to receive a **final grade of 50+**.

Prerequisites:

CHMB20 Chemical thermodynamics and Elementary Kinetics. Without it, you will not be allowed to take the course by the Office of Registrar!

MATA23 Linear Algebra and *MATB41H3 Techniques of the Calculus of Several Variables* are highly recommended. You will need to take them anyways if you are going to take a 3rd year physical chemistry course.

Course Description: This course uses quantum mechanics extensively to describe atomic and molecular structure and bonding, including valence bond and molecular orbital theory. The theory of these systems will be treated first and their spectroscopy afterwards. The list of topics is as follows.

- Motivation for quantum mechanics, Schrödinger equation, quantum postulates and formalism
- Quantum mechanics of simple systems: particle in a box, harmonic oscillator, rigid rotor, hydrogen-like atoms; angular momentum operator
- Electron spin, many electron atoms
- Theories of chemical bonding: valence bond theory and molecular orbital theory
- Quantum mechanics of the internal motion of molecules; spectroscopy of the atomic and molecular systems

Recommended Texts:

- https://www.youtube.com/playlist?list=PLm8ZSArAXicL3jKr_OnHHs5TwfhdkMFhh (Links to an external site.)
- Atkins, J. de Paula, J. Keeler: Atkins' Physical Chemistry: Quantum chemistry, spectroscopy, and statistical thermodynamics
- A. McQuarrie, Quantum Chemistry; T. Engel Quantum Chemistry,
- Spectroscopy 3rd edition or T. Engel and P. Reid, Physical Chemistry 2nd edition.

Midterm:

There will be a **2-hour mid-term test written during one of the classes after Reading Week**. If you miss the mid-term due to a legitimate reason, you must submit appropriate documentation *within one week of your absence*. 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 (Links to an external site.)

and completed by your physician. Students with a validated absence will be permitted to write a make-up exam. ***If no acceptable documentation is received, you will receive a grade of zero for that test.***

Final Examination:

There will be a **2-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. e.g. for a missed April Final Exam, the make-up exam is in August. Your documentation is crucial for a successful petition and must be submitted by the last day of the exam period. Check the UTSC Calendar for instructions and deadlines.

Labs:

The laboratory component of CHMB21 is **compulsory**. In order to pass the course, you must also pass the lab component. Attendance at all labs is expected. Attendance is taken in labs. If you need to miss a laboratory period for any *valid* reason, you must contact the lab TA by e-mail *before* your next scheduled lab period. If the reason for your absence is medical, you must download a UTSC Medical Certificate and have it completed by your doctor (download at:

http://www.utsc.utoronto.ca/~registrar/resources/pdf_general/UTSCmedicalcertificate.pdfLinks to an external site.

The completed note must contain the following information:

- Verification that you were examined on or before the day of your missed lab
- The nature of your illness
- A statement indicating the physician's professional opinion as to whether you should receive special consideration on medical grounds

Submit your completed medical note to TA within one week of your absence. The make-up lab will be arranged with your TA.

The lab manual will be available for download from the course page on Quercus.

On 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 (www.governingcouncil.utoronto.ca/policies/behaveac.htm) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

In papers and 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 exams:

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, including (but not limited to) doctor's notes.

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 behaviour 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.utoronto.ca/academicintegrity/resourcesforstudents.htmlLinks to an external site.).

On Accommodation:

The University provides academic accommodations for students with disabilities in accordance with the terms of the Ontario Human Rights Code. This occurs through a collaborative process that acknowledges a collective obligation to develop an accessible learning environment that both meets the needs of students and preserves the essential academic requirements of the University's courses and programs.

For more information on services and resources available to instructors and students, please contact Tanya Lewis, Director, Academic Skills and Accessibility Services at 416-978-6786;

tanya.lewis@utoronto.ca.