CHM 151Y: CHEMISTRY: THE MOLECULAR SCIENCE

Fall 2020/Winter 2021 Course Syllabus

I TEACHING TEAM

COURSE COORDINATOR
Name: Professor Andrew Dicks
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INSTRUCTOR (Organic Chemistry, Weeks 1 – 8)
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INSTRUCTOR (Inorganic Chemistry, Weeks 9 – 16)
Name: Professor Douglas Stephan
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Online student hours: to be arranged

INSTRUCTOR (Physical Chemistry, Weeks 17 – 24)
Name: Professor Al-Amin Dhirani
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Online student hours: to be arranged

LABORATORY COORDINATOR (Fall Semester)
Name: Dr. Marvin Morales
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Online student hours: by email appointment

COURSE COMMUNITY DIRECTOR
Name: Mark Croxall
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II COURSE OVERVIEW

Welcome to the Chemistry Department's special introductory course for those who enjoy chemistry and are considering specializing in the field or a related area! Within CHM 151Y we will emphasize areas that lead you to the frontiers of chemistry research while addressing important fundamental principles. Through appropriate examples, we will focus on modern topics of interest that let you know what the field has to offer from a number of different perspectives. These include the development of new characterization techniques, the design of organic compounds, and the properties and potential uses of advanced materials.

The first section of the course is an intensive study of the principles of structure and reactions of organic molecules, as well as an introduction to the importance of organic molecules in biological processes. The next section introduces methods of structure determination, and the properties and uses of inorganic elements including novel materials and catalysts. Finally, the last section covers the physical principles that underlie atomic molecular structure, reactivity and energy as well various applications ranging from atomic spectra to solar cells and climate change.

We hope CHM 151Y will exceed your expectations. We are here to support your learning, are invested in your success and would appreciate your comments and suggestions so that we can make this course as helpful and interesting as possible. Do feel free to discuss any matters with the course coordinator, instructors, laboratory coordinators and tutors.

STUDENT LEARNING OUTCOMES:
Upon successful completion of this course, students will be able to:

- understand and appropriately represent the structure and bonding in commonly encountered functional groups found in organic molecules
- understand and apply concepts of stereochemistry and conformation to the structures of acyclic and cyclic molecules
- understand and utilize arrow pushing as applied to reaction mechanisms in organic molecules
- understand the general scientific process of interpreting nuclear magnetic resonance (NMR), infra-red (IR) and mass spectroscopy (MS) data to determine chemical structure
- understand and apply the basic theories of chemical bonding and notions of molecular shape in the context of inorganic chemistry
- understand and interpret general property and reactivity trends as well as some applications of the elements across the periodic table
- understand the wave-particle nature of matter and some of the related implications: the H-atom (energy levels, orbitals), periodic table features, molecules (bonds, energy levels, orbitals), light-matter interactions (the H-atom, chlorophyll, solar cells)
- understand the laws of thermodynamics and some of their applications: ideal gas processes, chemical reactions, climate change
- understand and interpret rates of chemical reactions (zero-, first-, second-order and Michaelis-Menten enzyme kinetics) and some related applications

PREREQUISITE COURSES:
This course assumes you have a fundamental understanding of high school (Grade 12) principles of chemistry and mathematics. More specifically, Chemistry SCH4U and Mathematics MHF4U + MCV4U (or their equivalent) are all *required* prerequisite courses. Working knowledge of introductory organic chemistry as outlined in the Ontario Grade 12 curriculum (more specifically the first three chapters of "Organic Chemistry" by J. McMurry, the required organic chemistry textbook for the course) is additionally assumed. Physics SPH4U (or its equivalent) is a *recommended* prerequisite course.
CHM 151Y is a prerequisite for all 200-level Chemistry courses that are required towards a Chemistry program of study (specialist, major or minor). The specific 200-level courses and how they are connected to each program are listed here: chemistry.utoronto.ca/current-students/second-year-chemistry-course-requirements.

REFERENCE MATERIAL:
The *required* textbook for the organic chemistry section of the course (Weeks 1 – 8 inclusive) is "Organic Chemistry", 9th edition by J. McMurry plus the optional accompanying Study Guide and Solutions Manual. Both of these will also be used in second year organic chemistry courses (*CHM 151Y students are very strongly recommended to take CHM 249H: Organic Chemistry*). The 8th edition of McMurry can also be used with information posted on the course Quercus website that gives the translation of the numbering of problems at the end of the chapters.

The *required* textbook for the physical and inorganic chemistry parts of the course is "Chemistry: The Molecular Nature of Matter and Change", by M. S. Silberberg. The Canadian edition, 6th edition and 5th edition are all permissible versions. The student Solutions Manual is optional.

A molecular model kit will be very useful for most of the course. The "Molecular Visions" kit by Darling Models is recommended for this, as well as other undergraduate organic chemistry courses at U of T, although other model kits are helpful too. Models may be used as an aid in online assessments.

III HOW THE COURSE IS ORGANIZED

CHM 151Y has three instructional components to it: classes, tutorials, and laboratories. Each of these will be delivered completely online during the Fall 2020 semester (i.e. there are no scheduled in-person activities or assessments). Over the course of each week, you are expected to fully participate in the various activities that are taking place. **Arrangements for the Winter 2021 semester will be communicated in due course.**

CLASSES:
Classes will be live-streamed on MWF from 12–1 p.m. Eastern Time (ET), and additionally recorded for students who are unable to attend live for whatever reason. Please note that reading the posted class notes and/or textbook is not a substitute for attending classes! It is essential that you attend the live classes and/or review the recordings afterwards in order to solidify your understanding of the fundamental course material. Information regarding how classes will be broadcast will be available on the course website.

TUTORIALS:
Tutorials begin the week of Monday 21st September. These are live-streamed and interactive small-group problem-solving sessions run by a teaching assistant that build on the class material that has previously been taught: as such, your attendance is extremely important. **Tutorials will not be recorded.** The times of the tutorials are as follows:

TUT0101 & TUT9101 (two sections): T 10–11 a.m. ET
TUT0201 & TUT9201 (two sections): W 1–2 p.m. ET
TUT0301 & TUT9301 (two sections): F 1–2 p.m. ET

LABORATORIES:
Laboratories are a mandatory component of CHM 151Y. During the Fall 2020 semester, the laboratory sessions will take place on alternate Mondays (section PRA0101) or alternate Tuesdays (section PRA0201) starting at 2 p.m. ET.

Note: if you have enrolled in practical section PRA0101, your first session will be held on Monday 5th October, with subsequent sessions on 19th October, 2nd November, 16th November and 30th November. If you have enrolled in practical section PRA0201, your first session will be held on Tuesday 6th October, with subsequent sessions on 20th October, 3rd November, 17th November and 1st December. If you have not yet registered for a practical section on ACORN, please get in contact with Prof. Andrew Dicks (see information on p. 1).

The purpose of the Fall semester laboratories is to introduce you to basic techniques that will prove useful in more advanced organic chemistry courses. Though online laboratories cannot provide a direct hands-on experience, they can teach invaluable lessons about practical work and safety and provide you with a good sense of what to expect in an actual laboratory setting. The Fall laboratories in this course include four "wet" organic experiments and one computational exercise. The schedule of the laboratories will be posted on Quercus during September.

The online "wet" laboratories will involve a combination of *(a)* videos, *(b)* written materials (such as background readings and experimental procedures), and *(c)* synchronous online discussion sessions with a teaching assistant. In advance of each laboratory, we expect you to read all assigned materials, watch the relevant videos, answer pre-laboratory questions, and complete a quiz. After each laboratory, you will submit a written report. All laboratory materials, the quizzes, the online laboratory sessions, and the laboratory reports will be handled through Quercus.

Because the sessions with your teaching assistant are meant to be interactive and discussion-based, we expect that you will attend and actively participate in every session. These sessions are also an excellent opportunity to ask your teaching assistant any questions you might have about the content of each laboratory. In general, we expect you to closely monitor and follow all instructions, announcements, and other communications from instructors and your teaching assistant. In an online course, communication is especially important; if you have any questions or concerns about the "wet" laboratories, please contact the laboratory instructor, Dr. Marvin Morales (see information on p. 1).

An important complement to the online "wet" laboratories is a computational exercise, which will give you practice in performing calculations to understand the structures and properties of some organic compounds. **This will be the first activity on Monday 5th/Tuesday 6th October:** if you have any questions or concerns about the computational exercise, please contact the departmental computational instructor, Dr. Mima Staikova (mima.staikova@utoronto.ca).

The Winter 2021 laboratories focus on experiments in physical/inorganic chemistry and will operate according to the guidelines provided by the Faculty of Arts & Science in December 2020. More details will be forthcoming at a later time.

IMPORTANT FALL 2020 SESSIONAL DATES:
First Day of F & Y classes: Thursday 10th September 2020
Thanksgiving (no classes): Monday 12th October 2020
Fall Reading Week (no classes): Monday 9th – Friday 13th November 2020
Last Day of F & Y classes: Wednesday 9th December 2020
Make-Up Day: Thursday 10th December 2020
December Assessment Period: Friday 11th – Tuesday 22nd December 2020

IMPORTANT WINTER 2021 SESSIONAL DATES:
First Day of S classes/Y classes resume: Monday 4th January 2021
Family Day: Monday 15th February 2021
Last Day to Drop Y Courses: Monday 15th February 2021
Winter Reading Week (no classes): Monday 15th – Friday 19th February 2021
Good Friday (no classes): Friday 2nd April 2021
Last Day of S & Y classes: Monday 5th April 2021
Study Day: Tuesday 6th April 2021
April Assessment Period: Wednesday 7th – Friday 30th April 2021

IV EVALUATION/GRADING SCHEME

Online homework: 5%
Laboratory: 25%
Term Tests: 50%
Final Assessment: 20%

MARK BREAKDOWN
Online homework: 5% (5 x 1% quizzes distributed throughout the Fall and Winter semesters)
Laboratory: 25% (including written laboratory reports)
*Test 1: (organic: Week 6)
*Test 2: (organic/inorganic: December assessment period)
*Test 3: (inorganic/physical: Week 18)
*Test 4: (physical: Week 22)
Final Assessment: 20% (cumulative: components of organic, inorganic & physical: April assessment period)

*note that the highest test grade earned from Tests 1, 2, 3 and 4 will be weighted at 20%, with each of the remaining three tests weighted at 10%.

**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 term tests/final assessment.

V COURSE COMMUNITY

CHM 151Y has a unique Course Community where the undergraduate experience in chemistry is greatly enhanced through a series of study-tip workshops, research seminars, course/program advice and social activities. Sixty-minute online Course Community meetings will run on Monday and Tuesday afternoons during weeks when laboratory time is not scheduled. These meetings are hosted by upper-year chemistry program undergraduates who have previously taken CHM 151Y. The schedule

and group assignments will be posted on the CHM 151Y Quercus website, under the "Course Community" module.

Note: if you have enrolled in practical section PRA0101, your first Course Community session will be held on Monday 21st September, with subsequent sessions on 28th September, 26th October, 23rd November and 7th December. If you have enrolled in practical section PRA0201, your first Course Community session will be held on Tuesday 22nd September, with subsequent sessions on 29th September, 27th October, 24th November and 8th December.

Bonus credit towards your CHM 151Y final course grade will be applied for attendance and participation at a minimum number of Course Community sessions throughout the academic year. More details regarding this will be made available at a later date. If you have any questions pertaining to the Course Community, please contact the Community Director, Mark Croxall (see information on p. 2).

VI COURSE POLICIES

- Course website: q.utoronto.ca (in your Quercus Dashboard, click on "CHM 151Y Fall 2020 – Winter 2021")

  Important: please check the Quercus course website regularly (daily!) for:

  - ✓ general course and laboratory information
  - ✓ class notes and recordings
  - ✓ important announcements related to all assessments, laboratories, tutorials and Course Community sessions

- Email will generally be responded to within 24 hrs. on weekdays. Email will only be accepted if: (1) You send it from your utoronto.ca account; (2) You identify yourself in the e-mail subject as a student in CHM 151Y and include your name and University of Toronto student ID number; (3) No attachments are sent; (4) You are aware that chemistry can be discussed through an online discussion much more effectively than by email, and that email is not a substitute for attending classes. The finalized student hours for instructors and tutors will be posted on the CHM 151Y Quercus website and they are additionally available by appointment.

  Important: please be sure to email only ONE person within the CHM 151Y instructional team, depending on the nature of your concern.

- 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. U of T does not condone discrimination or harassment against any persons or communities.

- Aspects of 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 sources depending on the specific facts of each situation and are protected by copyright: for questions about recording and use of videos in which you appear please contact your instructor. Students may not create audio or video recordings of classes with the exception of those students requiring an

accommodation for a disability, who should contact the instructor prior to beginning to record classes for written permission. Students creating unauthorized audio recording of classes violate an instructor's intellectual property rights and the Canadian Copyright Act. Students violating this agreement will be subject to disciplinary actions under the Code of Student Conduct. Course videos may not be reproduced or posted or shared anywhere other than the official CHM 151Y Quercus site and should only be used by students currently registered in the course. Recordings may be saved to students' laptop for personal use.

- Laboratory reports and online homework is to be submitted through the CHM 151Y Quercus website only. Late laboratory reports will be deducted at 10% per day, and online homework will not be accepted at all after the due date/time. Please be aware that completed laboratory reports will not be accepted once graded work has been distributed to the rest of the class.

- **There are no make-up term tests in CHM 151Y, and there are no make-up laboratory sessions.** Students who miss a scheduled term test must contact Prof. Andrew Dicks (see information on p. 1) to discuss their situation. Students who are absent from class for any reason (e.g., COVID-19 illness, other illness or injury, family situation) and who require consideration for missed academic work should report their absence through the online absence declaration. The declaration is available on ACORN under the Profile and Settings menu. Students who are absent from more than one term test will be assessed by an individualized, cumulative online oral examination that accounts for the weight of the missed work.

VII TECHNOLOGY REQUIREMENTS

- This course requires the use of computers, and unfortunately sometimes things can go wrong when using them. You are responsible for ensuring that you maintain regular backup copies of your files, use antivirus software (if using your own computer), and schedule enough time when completing an assignment (e.g. a laboratory report or online homework) to allow for delays due to technical difficulties. Computer viruses, crashed hard drives, lost or corrupted files, incompatible file formats, and similar mishaps are common issues when using technology, and are not acceptable grounds for a deadline extension of any kind.

- Specific technology requirements are required in order to participate and learn effectively in CHM 151Y. Some guidance from the U of T Vice-Provost, Students regarding this is available here: viceprovoststudents.utoronto.ca/covid-19/tech-requirements-online-learning

- If you are new to online learning, some general advice and tips for students is available here: onlinelearning.utoronto.ca/getting-ready-for-online

VIII INSTITUTIONAL POLICIES AND 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 (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 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.

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.academicintegrity.utoronto.ca/).

USE OF TURNITIN
Normally, students will be required to submit their course essays/lab reports to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site.

ACCESSIBILITY NEEDS
Students with diverse learning styles and needs are welcome in CHM 151Y. 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. If possible, please submit your accessibility letter at the beginning of the course and not right before an assignment is due.

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