CHM 238Y 2020: INTRODUCTORY INORGANIC CHEMISTRY
COURSE SYLLABUS: FALL 2020

I CONTACTS

INSTRUCTORS (IN ORDER OF APPEARANCE)

Prof. Datong Song (DS)
d.song@utoronto.ca
Office: Davenport Labs, room 343, 80 Saint George St.

Research: https://www.chemistry.utoronto.ca/people/directories/all-faculty/datong-song

Prof. Robert H. Morris (Course Spokesperson, RHM)
robert.morris@utoronto.ca
Office: Davenport Labs, room 344, 80 Saint George St.
Online student hours: 4-5 pm ET Mondays Nov., Dec.

Research: https://www.chemistry.utoronto.ca/people/directories/all-faculty/robert-morris

Prof. Geoffrey A. Ozin (GAO)
g.ozin@utoronto.ca
Office: Lash Miller Labs, room 326, 80 Saint George St.
Online student hours: TBA Mar., Apr.

Research: https://www.chemistry.utoronto.ca/people/directories/all-faculty/geoffrey-ozin

PRACTICAL LAB – CHM238Y1 PRA5101, 5102, 5201, 5202

Prof. John De Backere (JD)
john.debackere@utoronto.ca
Office: Lash Miller Labs, room 223, 80 Saint George St.
Online student hours: TBD in the Winter Term
TUTOR – CHM238Y1 TUT0101, 0201, 9101, 9201
Graduate student Bryton Varju (BV)
bryton.varju@mail.utoronto.ca

LAB DEMONSTRATORS –
Kasumi Hayashi (KH) – PRA5101 & PRA5102
Email: kasumi.hayashi@mail.utoronto.ca
Pranav Nair (PN) – PRA5101 & PRA5102
Email: pranav.nair@utoronto.ca
Alina Trofimova (AT) – PRA5201 & PRA5202
Email: alina.trofimova@mail.utoronto.ca
Amir Yeganeh (AY) – PRA5201 & PRA5202
Email: amir.yeganeh@mail.utoronto.ca

II COURSE OVERVIEW

COURSE DESCRIPTION:
CHM238Y is the first part (with CHM338H1) of a two-year sequence in Inorganic Chemistry, designed to illustrate and systematize the rich variety of structures, physical properties and reactions of compounds of the elements across and down the Periodic Table. The course covers an introduction to structure, symmetry and bonding of molecules and lattices; acid-base and redox reactions; d-metal complexes; chemistry of elements of the s and p blocks; inorganic materials and solid-state chemistry with applications in advanced technologies.
STUDENT LEARNING OUTCOMES:
At the end of the course, successful students will be able to:
• show knowledge and understanding of trends in the periodic properties of the elements and simple compounds that they form and how these relate to the underlying quantum structure of multielectron atoms.
• identify the symmetry and point group of molecules and how these are used to describe the bonding of atoms in molecules.
• show knowledge of the basic theories of bonding and how they are applied to simple molecules.
• appreciate the structures and energetics of molecular, semiconducting, and ionic solids.
• identify from their atomic structure the types of acid and bases in water and in nonaqueous solvents, and the factors that determine the strength of acid-base adducts.
• describe the coordination chemistry of transition metal ions in terms of acid-base chemistry and know the common bases (ligands) used to solubilize metal ions.
• describe common uses of acids and bases in industry, in the home and in research.
• identify oxidants and reductants and the factors that determine their electrochemical potentials.
• calculate free energies from electrochemical potentials and interpret Latimer Diagrams.
• describe common uses of oxidants and reductants in industry, in the home and in research.
• display a general knowledge and understanding of the properties, fundamental reactions and uses of significant compounds of hydrogen and the elements from groups 1, 2, and 13-18.
• demonstrate understanding of basic concepts underpinning the chemical and physical properties of solids (without much physics and mathematics) and how to orchestrate their functionality towards enabling practical applications in the real world.

PREREQUISITE COURSES:
CHM151Y/(135H, 136H) with a minimum grade of 63%.
This course assumes you have a basic understanding of first year chemistry.

This course is a prerequisite for the following course(s): Intermediate Inorganic Chemistry (CHM338H), Introduction to Inorganic and Polymer Materials Chemistry (CHM325H), Organometallic Chemistry and Catalysis (CHM432H), Advanced Materials Chemistry (CHM434H), and Bioinorganic Chemistry (CHM437H).

READINGS:
Course notes from the QUERCUS website at https://q.utoronto.ca/courses/183132.

Book available at the University of Toronto Bookstore
E-book available at, for example: www.Vitalsource.com

Supplemental:
Reference text for the Materials section:
III HOW THE COURSE IS ORGANIZED

This course is organized by:

- two classes each week (M and W at 3:00 pm ET) starting on September 14, 2020 (CHM238Y1 LEC0101) on-line only using Bb Collaborate at https://q.utoronto.ca/courses/183132/external_tools/246.
- one tutorial for each of two sections (see below). Some students will attend in person and the rest on line via Bb Collaborate at https://q.utoronto.ca/courses/183132/external_tools/246.
- and one practical lab or virtual substitute (CHM238Y1 PRA5101,5102,501,5202) every other week starting in-person on Jan. 12, 2021 (activities and dates to be announced).

In a fully online course there is no in-person scheduled classroom time. Over the course of each week, you are expected to watch and take notes on the classes uploaded, read the relevant sections in the textbook and make note of questions to ask the instructor or tutor, answer the assigned questions to be taken up at the tutorial, and participate in the tutorial and practical sections. You must answer at the course website the quiz questions and the midterm tests as instructed according to the due dates. Recordings of the classes will be available to view asynchronously. Tutorials will be available only as online synchronous and in person at their scheduled times. It is recommended that you have a computer with a microphone and camera in order to participate in online activities. The list of topics in the Course Schedule below is subject to change due to unforeseen circumstances.

COURSE SCHEDULE & RELEVANT SESSIONAL DATES:

<table>
<thead>
<tr>
<th>FALL DATES</th>
<th>WEEK</th>
<th>TOPICS (Instructors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept. 14</td>
<td>1,2</td>
<td>Introduction to CHM238 (DS, RHM, GAO, JD, BV), Bb Collaborate The Periodic Table and atoms (DS) First tutorial (BV)</td>
</tr>
<tr>
<td>Sept. 14 – Sept. 25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sept. 24, 25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sept. 28-Oct. 9</td>
<td>3,4</td>
<td>Molecular symmetry (DS) QUIZ 1 due on Sept. 28</td>
</tr>
<tr>
<td>Sept. 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct. 12</td>
<td></td>
<td>Thanksgiving holiday</td>
</tr>
<tr>
<td>Oct. 14</td>
<td>5</td>
<td>Molecular symmetry (DS) Bonding in diatomic molecules (DS)</td>
</tr>
<tr>
<td>Oct. 19-23</td>
<td>6</td>
<td>Bonding in polyatomic molecules (DS) QUIZ 2 due on Oct 19</td>
</tr>
<tr>
<td>Oct. 19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct. 26</td>
<td>7</td>
<td>MIDTERM TEST 1 due on Oct 26 Bonding in polyatomic molecules (RHM)</td>
</tr>
<tr>
<td>Oct. 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov2-6.</td>
<td>8</td>
<td>Reactions: Acids and bases (RHM)</td>
</tr>
<tr>
<td>Nov. 9-13</td>
<td></td>
<td>Fall reading week</td>
</tr>
<tr>
<td>Nov. 16</td>
<td>9,10</td>
<td>QUIZ 3 due on Nov. 16 Acids and bases and non-aqueous media (RHM) Coordination compounds (RHM)</td>
</tr>
<tr>
<td>Nov. 16-Nov. 27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov. 30-Dec. 4</td>
<td>11</td>
<td>Coordination compounds (RHM)</td>
</tr>
</tbody>
</table>
| Dec. 7-Dec. 9 | 12 | QUIZ 4 due on Dec. 7  
Reactions: Oxidation and Reduction (RHM) |
|-------------|----|-------------------------|

**WINTER DATES**

| Jan. 4-15  
Jan 12, 14 | 1,2 | Introduction to crystal field and ligand field theories and magnetism (DS)  
LABS START IN PERSON (JD) |
|-------------|----|--------------------------|

| Jan. 18-Jan. 29 | 3,4 | MIDTERM TEST 2 due on Jan. 18  
Descriptive chemistry and periodicity (DS) |
|-------------|----|--------------------------|

| Feb. 1-Feb. 12 | 5,6 | QUIZ 5 due on Feb. 1  
Introduction to crystal structure, metallic and ionic solids (DS) |
|-------------|----|--------------------------|

<table>
<thead>
<tr>
<th>Feb. 15-19</th>
<th></th>
<th>Winter reading week</th>
</tr>
</thead>
</table>

| Feb. 22-Feb. 24 | 7 | QUIZ 6 due on Feb. 22  
Introduction to solid state materials chemistry (GAO) |
|-------------|----|--------------------------|

| Mar. 1-12-Mar. 8 | 8,9 | Bonding and electronics of solids (GAO)  
QUIZ 7 due on Mar 8 |
|-------------|----|--------------------------|

| Mar. 15-26-Mar. 29-Mar. 29-31 | 10,11 | Defects and non-stoichiometry (GAO)  
MIDTERM TEST 3 due on Mar. 29  
Solid state ionics (GAO) |
|-------------|----|--------------------------|

<table>
<thead>
<tr>
<th>Apr. 1</th>
<th></th>
<th>Classes end</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Apr 14</th>
<th></th>
<th>Final Assignment due on Apr. 14 at 11:59 pm</th>
</tr>
</thead>
</table>

**TUTORIALS CHM238Y1 TUT0101,0201,9101,9201):**

For groups TUT 0101 (in person) and TUT 9101 (on-line): tutorials will be held on certain Thursdays (see the Tutorial schedule below) at 1 pm ET where group TUT0101 will attend in person and group TUT9101 will attend online via Bb Collaborate at  
[https://q.utoronto.ca/courses/183132/external_tools/246](https://q.utoronto.ca/courses/183132/external_tools/246). Only students registered in TUT0101 should come to the class for safety reasons. These students must abide by the rules of University and wear a non-medical mask, practice social distancing and good hygiene maintenance and not enter the class if you display symptoms of illness.

For groups TUT0201 (in person) and TUT9201 (on-line): tutorials will be held on certain Fridays (see the Tutorial schedule below) at 2 pm where group TUT0201 will attend in person and group TUT9201 will attend online via Bb Collaborate at  
[https://q.utoronto.ca/courses/183132/external_tools/246](https://q.utoronto.ca/courses/183132/external_tools/246). Only students registered in TUT0201 should come to the class for safety reasons. These students must abide by the rules of University and wear a non-medical mask, practice social distancing and good hygiene maintenance and not enter the class if you display symptoms of illness.

**Tutorial objectives:** Questions, including those from the text, intended to encourage active learning of the material, will be assigned after each section and then taken up, when requested, by the tutor at the tutorial. Questions from students that arise from the classes and reading material will also be answered by the tutor so that the whole group can learn. These questions can form the basis of examination questions. All students must attend and participate in their assigned tutorial sections.
**Tutorial schedule**

<table>
<thead>
<tr>
<th>Tutorial Number</th>
<th>TUT 0101 (in LM158) + TUT 9101 (at Bb Collaborate) Thursday 1:00-2:00</th>
<th>TUT 0201 (in LM158) + TUT 9201 (at Bb Collaborate) Friday 2:00-3:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sept. 24</td>
<td>Sept. 25</td>
</tr>
<tr>
<td>2</td>
<td>Oct. 8</td>
<td>Oct. 9</td>
</tr>
<tr>
<td>3</td>
<td>Oct. 22</td>
<td>Oct. 23</td>
</tr>
<tr>
<td>4</td>
<td>Nov. 5</td>
<td>Nov. 6</td>
</tr>
<tr>
<td>5</td>
<td>Nov. 26</td>
<td>Nov. 27</td>
</tr>
<tr>
<td>6</td>
<td>Jan. 14</td>
<td>Jan. 15</td>
</tr>
<tr>
<td>7</td>
<td>Jan. 28</td>
<td>Jan. 29</td>
</tr>
<tr>
<td>8</td>
<td>Feb. 11</td>
<td>Feb. 12</td>
</tr>
<tr>
<td>9</td>
<td>Mar. 4</td>
<td>Mar. 5</td>
</tr>
<tr>
<td>10</td>
<td>Mar. 25</td>
<td>Mar. 26</td>
</tr>
</tbody>
</table>

**LABORATORY OBJECTIVES (CHM238Y1 PRA5101,5102,501,5202):**

Upon completing the practical experiments of this course, you will be able to:

i) safely synthesize and characterize a variety of inorganic compounds using standard laboratory techniques and spectroscopic methods;

ii) apply the fundamental principles learned in lecture to explain the properties and aspects of the inorganic systems investigated;

iii) interpret data and clearly/concisely communicate results using proper scientific writing through lab reports;

iv) use the scientific literature to prepare for, understand, and evaluate experimental procedures and results.

See your Quercus CHM238Y1 PRAX0X webpage for more information.

**IV EVALUATION/GRADING SCHEME**

QUIZZES (seven in total, best six) worth 3% each*

MIDTERM TESTS (three in total on Oct. 26, Jan. 18 and Mar. 29, best two) worth 15% each**

LABORATORY worth 30%

FINAL ASSIGNMENT (April final assessment period) worth 22%

*Quizzes are all open book but should be completed without conferring with others unless advised otherwise.

**Tests will have a time limit and must be done individually.

**MARK BREAKDOWN**

Quizzes: 6 x 3% = 18% of final grade
Midterm tests: 2 x 15 % = 30% of final grade
Lab: 30% of final grade
Final ASSIGNMENT: 22% of final grade
Total: 100%

**Note:** 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 assessments.
V  COURSE POLICIES

- We will respond to email within 24 h on weekdays.
- All members of CHM238 agree to fulfill the University’s statement regarding a positive learning environment: “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.”
- 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.
- Deadlines for assignment submissions are given in section III above. 10 % will be deducted daily for late assignments.
- All assignments will be submitted at the QUERCUS website.
- If you believe that an error has been made in the marking of your work please contact Professor Morris.
- If you miss classes, assignments or tests for medical reasons please inform Professor Morris immediately by email.
- No extensions or make-up work will be considered.

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 of course 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 to allow for delays due to technical difficulties. Computer viruses, crashed hard drives, broken printers, 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.
VII  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 (https://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 and laboratory reports:
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 https://www.academicintegrity.utoronto.ca/).

Use of Turnitin
Normally, students will be required to submit their course essays 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.
COPYRIGHT
If a student wishes to copy or reproduce lecture 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 (https://studentlife.utoronto.ca/department/accessibility-services/) as soon as possible.

ADDITIONAL SERVICES and 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 (https://studentlife.utoronto.ca/)
- Full library service through University of Toronto Libraries (https://onesearch.library.utoronto.ca/)
- Resources on conducting online research through University Libraries Research (https://onesearch.library.utoronto.ca/research)
- Resources on academic support from the Academic Success Centre (https://studentlife.utoronto.ca/department/academic-success/)
- Learner support at the Writing Centre (https://writing.utoronto.ca/)
- Information for Technical Support/Quercus Support (https://q.utoronto.ca/courses/46670/)
- Recognized Study Groups (RSG) at https://sidneysmithcommons.artsci.utoronto.ca/recognized-study-groups/ are voluntary, peer-led study groups of 3 – 6 students enrolled in the same course. They’re available for all A&S courses and are now fully online. In addition to supporting students’ study habits and academic success, RSGs also encourage student participants to be socially connected with their peers. Last year, over 2,000 A&S students participated in RSGs for courses spanning all streams and class sizes.
- Meet to Complete https://sidneysmithcommons.artsci.utoronto.ca/meet-to-complete/ are online drop-in study sessions held exclusively for A&S undergrads. Offered multiple times per business day and led by trained A&S student-staff, these study sessions help students to stay motivated and productive by offering daily goal-setting and the opportunity to study alongside their A&S peers.