SYLLABUS

Topics in Inorganic Chemistry

CHMD39H3, Fall 2021

Instructor Information

Instructor	Email	Office	Office hours will be announced on Quercus before semester starts.
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Introduction

The aim of CHMD39 course are to serve as a review of important concepts in (inorganic) chemistry, introduce new material traditionally not covered in the core chemistry curriculum, and cover the topics on the borderlines of the discipline. The material is such that it requires solid knowledge of both levels of inorganic chemistry—I hope you kept some notes, textbook or similar from before. Some topics covered this year are provided below, without any fixed scheduling. The brand new material (topics that have no previous mention in the curriculum) will require us to have more of a typical lecture, while for the other topics we'll try to have a discussion and QandA conversations, which would require you to do some prep before hand for the class—call it a "flipped classroom" if you'd like.

A Note on Course Delivery for Fall 2021

Our course will be delivered on-line again this year. The course will be delivered in synchronous mode, live and will be recorded. The lectures will take place on scheduled time. The platform we are going to use will be announced (either MS Teams or Zoom – the final decision has not been made yet). If we change anything in the delivery mode, you will be notified, so keep a keen eye on the course announcements. There is also strong evidence indicating that having a schedule and well-defined timetable enhances knowledge retention and overall performance in the course. Hence, synchronous delivery was chosen.

If any of you are in the different time zone and are worried about synchronous delivery – rest assured that your situation will be considered.

Course Content

This year the course is focused on f-block chemistry (lanthanoids and actinoids) and molecular structure. The f-block is generally "neglected" in the curriculum, and they are included in this year's course offering. We will use the f-block to review basic topics from both CHMB31 and CHMC31 without which the discussion is not going to go smoothly. For molecular structure, a brand-new topic for you will be X-ray structural analysis, focused on the results not so much on the technique. The results of X-ray analysis are routinely published in journals and textbooks for all chemistry disciplines. Thus, it is especially important for you, as chemists, be able to understand what the data mean, what to look for and how to critically evaluate (but not over-evaluate) the published results. The single crystal X-ray analysis can be done in TRACES and many of CHMD90/D91 inorganic chemistry students have the results in their final reports and deposited in structural databases.

We shall also have a quick peak into history of chemistry. Knowing some history of science (and philosophy as well) greatly enhances the understanding of how science works. Our textbooks and lectures, focusing on the knowledge and facts of the day, really do not show how science really works and how the presented knowledge is sought, corrected, refined, and accumulated.

Here is the list of topics we are going to cover:

1. A bit of review: Atomic properties and periodic trends
    - You need to review of atomic properties from CHMB31 and first lecture from CHMC31
2. The f-block: general properties
    - Some parts of this material are review from the first CHMC31 lecture
3. Isolating the f-block elements
    - A bit of history and industry in relationship to the chemical properties of the elements
4. Chemistry and compounds of f-block elements
    - Binary compounds: overview and preferred bonding
    - Coordination and organometallic chemistry (all that this covers: bonding, geometries, syntheses, reactivity, uses….)
5. A bit of review: solid state structures, symmetry, bonding etc.
    - You will need to have a look at relevant CHMB31 (simple solid state structures) and CHMC31 (symmetry and bonding in coordination compounds) for this lecture
6. Understanding published single crystal X ray analysis data and results

- This is kind of new….

7. More from IR and NMR spectroscopies: a few case studies from literature
    - As some of you requested, fluxional compounds will be covered as well as some historically important main group and d block compounds
8. What else can be done with structural data?
    - Parametrization of metal complexes and ligands
    - Metal separation (this will focus on f-block chemistry)
    - Catalysis and structure (again focus on f-block chemistry)

The above is a list of topics we will talk about, not necessarily a week-by-week lecture schedule. The actual lecture content and all materials will be announced on the Quercus through course modules. For each lecture there will be a short overview available on the learning portal (Quercus) outlining the **required** readings, suggested readings, lecture goals and questions that go beyond the material we would like to cover in during the lecture. Some lectures will have little material provided (i.e. a few or no lecture slides) and will focus on research and review articles. Considering all of this, the course does not have a textbook, although your CHMB31/C31 textbook is still useful as a background source.

If needed, the relevant lecture notes from CHMB31 and CHMC31 will be re-posted on CHMD39 site (just in case you 'lost' them….). Other listed readings you will have to locate through the UofT library catalogue and will be available on-line.

The list might look like a slapdash collection of topics that your instructor dreamt up during a delirium, but as you will see each topic leans on the one before (more-or-less). Thus, if we do not cover all material during one lecture, we can easily move the 'leftovers' to next week or discussion board on blackboard. It will also demonstrate what is expected from you in the evaluations.

I would like to have discussion and fluidity in the class as opposed to a strict lecture-by-lecture material-at least on the topic you have previous background knowledge. This requires that you prepare before the lecture – gather listed readings, read them, figure out questions, things that caught your attention etc. I know how difficult it is to extract anything from students during the regular class, I can only imagine the difficulty it is going to be on-line. But – we have to do our best to discuss and think about the points we missed before, or points that need more clarification. In short,

I expect class participation in this course, more than in any other, particularly on the review topics (material from CHMB31 and CHMC31).

Evaluation components:

Assignment (homework): 10%

Paper (on selected topic): 25%

Short presentation (on above paper): 25%

Discussions/preparation/participation: 10%

Final exam: 30%

The assignment. For the assignment you will have to write a short summary (or 'review') of three or more assigned articles/book parts (those will be given in the assignment). The length of summary depends on the number of assigned articles and topic and will be communicated to you in the assignment. On top of this—I consider everything to be a fair game (calculations, reactivity, etc.) at this level and in this course type.

Paper/short presentation. You can pick a topic your own topic, but I would strongly advise you to check with me if the topic is acceptable and if the content is still on the right track as you work on your paper. The main criterion is that your topic has to touch at least two of the course themes:

- structural methods (X-ray, IR etc.),
- synthesis,
- historically important inorganic/organometallic structural problems,
- history of f-block chemistry,
- fundamental and applied research in f-block chemistry, and
- application of structural results and research.

Your paper should be concise, about 7-8 pages in length with 5-7 sources used (as current as possible unless you are focusing on history!). You will have a 15-minute presentation based on this paper followed by Q&A. The presentations will be scheduled in class at the end of the course. The presentation schedule will be posted at least one week before the presentations start.

Discussions. One of the overall goals of this course is to make you review, question and re-think the material covered in earlier courses (starting from high school science classes, if necessary). This prior knowledge is expected and fundamental for understanding of the in-class material. This part of evaluation will look at your ability to ask questions and navigate through old and new and make relevant connections through discussions.

Final exam. Our final exam will be cumulative and scheduled outside regular class hours. The exam will be based on several research papers – which will be given to you in advance of the exam. The questions will be based on the papers and integrative, i.e. would cover more than one topic listed above, because (again) you have to show the ability to relate two or more complex concepts in one coherent answer. Keep in mind that you are not supposed to be experts in all we cover; rather you have to be able to comfortably navigate through material that could usually be found in published full papers. A good hint: look at the questions at the end of lecture hand-outs; some of them 'might' appear on the final.

Office hours and contact info

I can be reached via e-mail: alen.hadzovic@utoronto.ca.

My office is located in the Environmental Sciences and Chemistry Building, 5th floor, room EV568. It is not like we will have much use of that since our office hours will be scheduled virtually – although I will be on campus. The office hours' schedule will be posted on Quercus as soon as my schedule is finalized, hopefully prior to the start of the semester. If you would like to get in touch outside the office hours (for any reason), please e-mail me and we will schedule the time.

CHMD39H3 Resources

The reading materials are different for each lecture. They will be provided on the learning portal about a week before each lecture. An electronic copy (pdf file) will be provided only for the sources that are not available on-line through UofT system or physically at UTSC library – those are very few. Majority of material you will have to find following the provided list. Of course, you are free to use our inorganic chemistry textbook as refresher source, old CHMB31 and CHMC31 notes as well as any other material you find interesting.

Academic Integrity

Academic integrity is one of the cornerstones of the University of Toronto. It is critically important both to maintain our community which honors the values of honesty, trust, respect, fairness and responsibility. It also protects you, the student within our community as well as the value of the degree towards which you are all working so diligently. Detailed information about how to act with academic integrity, the Code of Behavior on Academic Matters, and the processes by which allegations of academic misconduct are resolved can be found online: Student Academic Integrity | Faculty of Arts & Science (utoronto.ca) and FAQ | Vice Principal Academic & Dean (utoronto.ca)

Section B of the University of Toronto's Code of Behaviour on Academic Matters (http://www.governingcouncil.utoronto.ca/policies/behaveac.htm) lists actions that are considered academic offences. Some of the most common offences are:

- 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 Behavior on Academic Matters.

Accessibility

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office (ability@utsc.utoronto.ca) as soon as possible. I will work

with you and AccessAbility Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC AccessAbility Services staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations. More details are available at: Welcome to AccessAbility Services | AccessAbility Services (utoronto.ca)

GOOD LUCK AND SEE YOU SOON!!

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