CHEM4610 Inorganic and Organometallic Chemistry of the Transition and Post-Transition Elements

The University of Toledo
Department of Chemistry and Biochemistry
College of Natural Sciences and Mathematics
CRN: 56212

Instructor: Dr. Joseph Schmidt
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Office Hours: Online only (by appointment)
Office: WO 3277
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Class Location: RH 1554
Class Day/Time: MW 2:00-3:50 PM
Credit Hours: 4 credit hours
Term: Fall 2020

COURSE/CATALOG DESCRIPTION
The organometallic chemistry of the transition metals, lanthanides and actinides is described. Synthesis, structure, bonding, and reactivity are considered. Applications in catalysis, bioinorganic, and materials chemistry are discussed.

COURSE STATEMENT
This course will introduce fundamental trends and concepts necessary to understand the inorganic and organometallic chemistry of the transition metals, lanthanides, and actinides. There will be appropriate coverage of synthesis, structure and bonding, and characterization, while the emphasis will be on molecular reaction chemistry. The fundamental concepts introduced throughout this course can be applied to diverse areas of research such as materials synthesis, homogeneous catalysis, and organic synthesis.

STUDENT LEARNING OUTCOMES
Students who successfully complete this course will be able to:
- Properly count valence electrons in inorganic compounds
- Understand the use of bonding theories in predicting reaction chemistry
- Describe the fundamental reactions operable with organometallic compounds
- Understand the basic principles of transition metal catalyzed processes
- Predict the relative kinetic rates of similar reactions
- Predict the reaction products of organometallic reactions
- Draw detailed mechanisms using arrow pushing notation for organometallic reactions

PREREQUISITES AND COREQUISITES
Prerequisites: CHEM 3610 (C or better)
REQUIRED INSTRUCTIONAL MATERIALS (TEXTS AND ANCILLARY MATERIALS)

**Required Materials:**
The primary textbook for this course is:

Note that the university has a site license for the electronic version of this book, which can be found at: [https://onlinelibrary.wiley.com/doi/book/10.1002/9781118788301](https://onlinelibrary.wiley.com/doi/book/10.1002/9781118788301)
UT is part of the OpenAthens federation; use your UTAD ID to confirm your identity.

**Supplementary Materials:**
Course material will be taken from numerous sources, including both textbooks and primary research literature. Good references for additional information include the following:


**COURSE STRUCTURE**

**Lecture:**
- Lecture sessions are designed to demonstrate and explain the concepts covered in this course and provide examples of what is expected of you.
- Attendance is expected and you are responsible for all material and problems covered in class.
- Please be considerate of your fellow students during the lecture period. Disruptions of any kind will not be tolerated and may result in expulsion from the classroom.

**Homework:**
Problem sets will be distributed periodically. These will be collected and graded. Answer keys will be posted on Blackboard following the due date for each set.
**Blackboard:**
Blackboard is a course management system provided by the University of Toledo and can be accessed at https://blackboard.utdl.edu/. Your access code is your UTAD user name and password.

You should consult the site regularly for news and announcements. Problem sets, answer keys, exam keys, and diagrams displayed in lecture will be posted to Blackboard. The system also permits you to check your grades at any time.

**SPECIAL COURSE EXPECTATIONS DURING COVID-19**

**Attendance:**
The University of Toledo has a missed class policy. It is important that students and instructors discuss attendance requirements for the course. Students must perform a daily health assessment, based on CDC guidelines, before coming to campus each day, which includes taking their temperature. Students who are symptomatic/sick should not come to class and should contact the Main Campus Health Center at 419-530-3451. Absences due to COVID-19 quarantine or isolation requirements are considered excused absences. Students should notify their instructors and these absences may not require written notice.

**Face Coverings:**
All students must wear face coverings while on campus, except while eating, alone in an enclosed space, or outdoors practicing social distancing. NO students will be permitted in class without a face covering. If you have a medical reason that prevents you from wearing a face covering due to a health condition deemed high-risk for COVID-19 by the Centers for Disease Control and Prevention (CDC), you should submit a request for an accommodation through the Student Disability Services Office (SDS) by completing the online application. Students will need to provide documentation that verifies their health condition or disability and supports the need for accommodations. If a student is already affiliated with SDS and would like to request additional accommodations due to the impact of COVID-19, they should contact their accessibility specialist to discuss their specific needs.

**Social Distancing:**
Students should practice social distancing inside and outside the classroom. Please follow signage and pay attention to the seating arrangements. Do not remove stickers or tape from seats and/or tables. This is there to provide guidance on the appropriate classroom capacity based on the recommended 6 feet of social distancing between individuals. Please be conscious of your personal space and respectful of others. Also be cognizant of how you enter and exit the room; always try to maintain at least 6 feet of distance between yourself and others.

**Desks and Work Spaces:**
Students will need to sanitize their desks and/or work space before class with the University provided sanitizing spray and paper towels.

**Special Notes:**
It is important to note that based on the unpredictability of the COVID-19 virus, things can change at any time so please be patient and understanding as we move through the semester. I also ask that you keep me informed of concerns you may have about class, completing course work/assignments timely and/or health concerns related to COVID. Unlike previous semesters, this syllabus is considered a fluid document and may need to be altered depending on the way the semester proceeds.
Examinations:
Grades will be based on three exams (100 points each) and homework problems (50 points).

- The midterm exams will be administered on Monday, September 28th (2:00 – 3:50 PM) and Monday, November 2nd (2:00 – 3:50 PM).
- The final exam (100 points) for the course will be administered online on Monday, November 30th at 2:45 pm, the time scheduled by the University.

Inclement Weather Policy: If classes are cancelled on the Wednesday preceding an exam week, the exam WILL PROCEED on Monday as normally scheduled. If classes are cancelled on the day of an exam, the exam will take place during the next regularly scheduled class period (for example, if a Monday exam is cancelled for weather, the exam will take place on Wednesday instead).

Exam Absence Policies
Students who will not be able to take an exam at the scheduled time due to an irresolvable conflict with a major responsibility must provide some written documentation to verify the conflict. This situation may occur for students on official university business, including athletes. Approval must be obtained before the scheduled test date.

Students who do not take an exam due to illness, car accident, and death in the family or similar extreme circumstance should inform their instructor of their difficulties within 24 hours of the exam. These difficulties must also be documented by a physician's note, an accident report, pastor’s note, etc. Contact information for the police department, pastor, etc. must be included on the note or report. In all other circumstances, a missed exam will result in a grade of 0. Exams cannot be excused for personal reasons. Examples of missing an exam due to personal issues include, but are not limited to: oversleeping, transportation problems, vacation plans, work schedule conflicts, child care issues, sick children, fire alarms in adjacent buildings, etc. Please plan accordingly.

Communication:
Please communicate with the instructor about any aspect of the course which concerns you or which might limit your success. The goal is for you to be successful in this course, whatever that takes.

OVERVIEW OF COURSE GRADE ASSIGNMENT
Midterm Grading
Midterm grading serves as a point in the term where the instructor of record may provide a midterm grade assessment and may identify any student who has never attended, has stopped attending, or who is not actively participating in the course. In addition, students may use midterm grade to help make a decision in regards to withdrawing from the course.

The U.S. Department of Education requires the University to document both active participation and satisfactory academic progress as part of the compliance with federal financial aid regulations. Students receiving Title IV Federal Aid funds are required to have regular attendance and satisfactory academic progress in their courses to receive federal aid.

Final Grading
Your final grades will be calculated based on a total of 350 points.
Drop, Withdrawal and Incomplete Grades:
- Course drop and withdrawal procedures have been set by the University faculty. Dropped courses do not appear on your transcript. If you are in a course after the deadline for dropping, there will be a grade on your transcript (A-F, W, or Incomplete).
- You may withdraw from the course and receive a grade of W. W’s do not affect your GPA. For both dropping the course or withdrawing you should go to the Registrar's webpage for further details. You do not need your instructor’s permission for either process. Please note that course registration changes might change your financial aid.
- A course grade of Incomplete is given only to those who have completed all but a small percentage of course requirements for an acceptable reason.

Academic Dishonesty:
As a student in this course and enrolled at The University of Toledo you should be familiar with the policies that govern the institution’s academic processes, for example, Academic Dishonesty, Enrollment Status, and Grades and Grading. Please consult the Graduate Academic Policies via the UT website.

Attendance/Class Participation:
On two occasions during the term, instructors are asked to report student attendance. These reports can affect your financial aid, so you will want to be sure that you are in attendance for all classes. However, you will remain enrolled in the class independent of these reports. That is, you remain registered for the class and will receive a final grade unless you take the action of dropping or withdrawing. Students are expected to attend every class meeting of courses in which they are registered. Please read the Missed Class Policy.

Special Needs:
If you have special needs with respect to your participation in this course, please make an appointment to discuss this matter with your instructor. The instructor will work with you and the Office of Accessibility to make appropriate accommodations for your needs.

UNIVERSITY POLICIES

Policy Statement on Non-Discrimination on the Basis of Disability (ADA)
The University is an equal opportunity educational institution. Please read The University’s Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance. Students can find this policy along with other university policies listed by audience on the University Policy webpage.

Academic Accommodations
The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an accommodations memo from Student Disability Services, I invite you to correspond with me as soon as possible so that we can communicate confidentially about implementing accommodations in this course. For students who have not established affiliation with Student Disability Services and are experiencing disability access barriers or are interested in a referral to healthcare resources for a potential disability or would like information regarding eligibility for academic accommodations, please contact the Student Disability Services Office (http://www.utoledo.edu/offices/student-disability-services/) by phone: 419.530.4981 or email at StudentDisability@utoledo.edu.

Academic and Support Services
Please follow this link to view a comprehensive list of Student Academic and Support Services (http://www.utoledo.edu/studentaffairs/departments.html) available to you as a student.
Safety and Health Services for UT Students
Please use the following link to view a comprehensive list Campus Health and Safety Services available to you as a student.

Inclusive Classroom Statement
In this class, we will work together to develop a learning community that is inclusive and respectful. Our diversity may be reflected by differences in race, culture, age, religion, sexual orientation, gender identity/expression, socioeconomic background, and a myriad of other social identities and life experiences. We will encourage and appreciate expressions of different ideas, opinions, and beliefs so that conversations and interactions that could potentially be divisive turn, instead, into opportunities for intellectual and personal development.

Academic Policies
Undergraduate Policies: http://www.utoledo.edu/policies/academic/undergraduate/

COURSE SCHEDULE
The following topics will be covered in the order listed. The specific dates assigned to each topic will depend on many factors, including overall pace of the course, weather conditions, university holidays, etc.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Most Relevant Book Chapters</th>
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<tbody>
<tr>
<td>Review of Ligands and Inorganic Bonding Concepts</td>
<td>Chapters 1-2</td>
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<tr>
<td>Ligand Substitution</td>
<td>Chapter 4</td>
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<td>Oxidative Addition</td>
<td>Chapter 6</td>
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<tr>
<td>Reductive Elimination</td>
<td>Chapter 6</td>
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<td>Insertion</td>
<td>Chapter 7</td>
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<td>Polymerization / Oligomerization</td>
<td>Chapter 12</td>
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<td>Reactions of Alkylidenes / Alkylidyynes</td>
<td>Chapter 11</td>
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<tr>
<td>Some Industrially Relevant Catalysis</td>
<td>Various Chapters</td>
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<tr>
<td>Additional Topics (as time permits)</td>
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