



**Organometallic Chemistry of the Transition
Elements
CHEM 714-001
Fall 2018**

Canvas Course URL: <https://canvas.wisc.edu/courses/105631>

Meeting Time and Location

Tuesday and Thursdays from 9:30 to 10:45 am in Room 8335 Chemistry Building

Instructional Mode + Credit Hour Accounting

Instruction in this course will primarily occur in a lecture format, although some periods will be devoted to other modes. The three credit hours derive from the traditional Carnegie Foundation definition – we meet for lecture for the equivalent of 150 min per week (two 75-min periods of faculty-student instruction). The credit standard for this course is met by an expectation of a total of 135 hours of student engagement with the course learning activities (at least 45 hours per credit), which include class attendance, reading, problem sets, and other student work as described in the syllabus.

INSTRUCTORS AND TEACHING ASSISTANTS

Associate Professor Daniel J. Weix

Office hours: Tues 2:30 to 3:20, Wed 2:30 to 3:20 in my office

Office: Rm 5132 Shain Tower, Chemistry

Phone: 262-0541

Email: dweix@wisc.edu (preferred method of contact)

While email is the preferred mode of contact, do not expect an immediate reply. Average turnaround will be about a day. In the event of an urgent matter (rare), be sure to call me directly.

OFFICIAL COURSE DESCRIPTION

Course Description

This course covers the fundamentals of organometallic chemistry, a branch of inorganic chemistry devoted to compounds with metal-carbon bonds that has had a broad impact in synthetic chemistry (both organic and inorganic). Starting from basic principles of bonding, ligand types, and fundamental reactions, the course will culminate with discussion of the mechanisms of complex transition-metal-catalyzed reactions that involve organometallic intermediates.

Requisites

Graduate Standing or Chem 511.

A quote that sums up what I think about learning and chemistry:

You are not engaged so much in acquiring knowledge as in making mental efforts under criticism. A certain amount of knowledge you can indeed with average faculties acquire so as to retain; nor need you regret the hours spent on much that is forgotten, for the shadow of lost knowledge at least protects you from many illusions. But you, go to school not for knowledge as much as for arts and habits; for the habit of attention, for the art of expression, for the art of assuming at a moment's notice a new intellectual posture, for the art of entering quickly into a person's thoughts, for the habit of submitting to censure and refutation, for the art of indicating assent or dissent in graduated terms, for the habit of regarding minute points of accuracy, for the habit of what is possible in a given time, for taste, for discrimination, for mental courage and mental soberness. Above all, you go to school for self-knowledge.

William Cory – Master at Eton College (1861)

LEARNING OUTCOMES

Course Learning Outcomes

Students in this course will learn about the basics of organometallic chemistry, building upon material learned in inorganic chemistry and organic chemistry. By the end of the semester, students will be able to write and interpret Lewis structures of organometallic complexes, explain the basics of bonding in organometallic complexes, predict and explain different ligand binding modes and their effect on a metal center, name fundamental organometallic reactions, and use this knowledge to propose reasonable mechanisms for organometallic reactions.

GRADING

Grading in this course will be based upon your scores on graded homework, a short midterm, and a short in-class final. Note that exams will happen during lecture and discussion section times. Finally, although statistical tools will be used to assist in setting the grading scale, a simple curve will not be enforced. It is possible for everyone in the class to receive an A grade.

Grading	Format	Points
homework	40 x 4	160
midterm	50	50
final	100	100
	Total	310

REQUIRED TEXTBOOK, SOFTWARE & OTHER COURSE MATERIALS

- **Required:** The Organometallic Chemistry of the Transition Metals, 6th Ed. by Robert H. Crabtree
- **Recommended:** Organotransition Metal Chemistry: From Bonding to Catalysis, by John F. Hartwig
- I will NOT be using Sapling
- I WILL be using Canvas

EXAMS, QUIZZES, PAPERS & OTHER MAJOR GRADED WORK

- Midterm and final are closed book. You are being graded on your mastery of the material and all work must be your own. No outside assistance of any kind is permitted, such as notes, books, or electronics.

- Homework assignments are open-note and book, but you should not seek out answers in the primary literature.
- Midterm: Oct 23 (tentative)
- Homework will be given out near the end of a section, dates TBD
- Final: Dec 11, in class
- Make up exams for planned, reasonable absences must be arranged in advance. Emergencies will be dealt with on a case-by-case basis in a humane way.

HOMEWORK & OTHER ASSIGNMENTS

There are four formally graded homework assignments for this course. Additional studying, such as working extra problems, flash cards, writing (and re-writing) summaries of topics, and team-based learning, will be required to obtain a high grade in this course.

RULES, RIGHTS & RESPONSIBILITIES

Beyond the normal duties of doing assignments (the [Guide's to Rules, Rights, and Responsibilities](#)), attending lecture, and trying your best, please:

1. *Do readings before lecture.* If you do this, you will find that lectures will make more sense, you'll be better able to participate, and you'll get a better grade.
2. *Ask questions.* I am bound to cover some topic poorly or make a mistake, leading to confusion. If you are brave enough to ask, your fellow students and I will be grateful.
3. *Do the homework problems.* I will not check them, but I expect you to do them. There is no better way to learn chemistry than by working problems!
4. *Study in groups and attend office hours.* The back-and-forth of explaining your reasoning to others and listening to how they think about the material is very helpful. It can be scary to "put yourself out there" intellectually, but it is worth it!

ACADEMIC INTEGRITY

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to studentconduct.wiscweb.wisc.edu/academic-integrity/.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform Prof. Weix of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible

after a disability has been incurred or recognized. Prof. Weix will work either directly with the you or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA. <http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php>

DIVERSITY & INCLUSION

Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world. <https://diversity.wisc.edu/>

TOPICS COVERED

Basics

- Introduction to transition metals
- Molecular orbital theory
- Electron-counting and formal oxidation state
- Electronic structure and molecular geometry

Ligands

- Ligand classes (L and X categories)
- Hard-soft acid-base theory
- Ancillary ligands
- Multiply bonded ligands
- Sigma-adducts

Fundamental Reactions

- Association, dissociation, and substitution
- Oxidative addition
- Reductive elimination
- Sigma-bond metathesis
- [2+2] Reactions
- Migratory Insertion
- β -elimination
- Nucleophilic attack on coordinated ligands
- Transmetalation

Homogeneous Catalysis

- Various topics