# Chemistry 165: Organometallic Chemistry, Syllabus
# Harvey Mudd College, Fall 2018
# Professor Adam Johnson

**Class Time, Location:** Tuesday, 9:30-10:50 AM, SHAN 2407
**Office hours:** by appointment
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**Course philosophy:** This course is an introduction to the primary literature using the field of organometallic chemistry as its textual source. For those of you who have taken inorganic chemistry, you will be well prepared to learn the concepts of organometallics. For those of you with less chemistry background, you will probably struggle with the technical material but will learn the important skills of reading and evaluating the primary literature. Students have been successful in this course as both juniors and seniors. However, you must do the reading and preparation outside of class in order to succeed. This is a discussion-heavy course, and failure to prepare will be *obvious*. If you are interested in my teaching philosophy and why I teach this course in this way, there are two documents on Sakai.

**Goals:** by the end of the course students will:
- describe the structure and bonding of organometallic compounds
- know the major reactions of organometallic chemistry
- read, analyze, interpret, and present results from the organometallic primary literature
- summarize both classic and recent organometallic research in concise form

**Text:** There is one required text for the class: The Organometallic Chemistry Lecture Notes written by Prof. George Stanley, from Louisiana State University. George has written a readable overview of the field and has shared it with the community. A link to the text is available on Sakai. Most of the discussion questions for this course were developed as part of faculty development workshops hosted by IONiC.

There are a number of organometallic texts that may be useful as general references. Recommended among these are Spessard and Miessler; Crabtree; Collman, Norton, Hegedus & Finke; and Elschenbroich. In addition, there is an excellent online resource: The organometallic hypertextbook (OMHTB, worth exploring on your own, http://www.ilpi.com/organomet/).

**Class format:** The first several weeks of the semester will introduce to the major themes in organometallics, including: structure, bonding, electron counting, and reactions. In the later weeks, we will discuss one primary literature paper per week, often considering supplemental articles that are closely related or provide a deeper or more recent analysis. We will refer back to pertinent text chapters necessary for understanding the paper. I expect you to become experts on the concepts and techniques described in each paper. We will cover both 'classic' papers that set the direction of research in the field, and 'modern' papers of current topical interest. All the papers and other reading assignments will be posted on the course Sakai site.

*Classic papers:* The continuing importance of the classic papers lies in the realization that many of the bonding, reactivity and mechanistic paradigms that we now take for granted were once completely unknown or merely fringe theories. These papers have in common a very high level of experimental design, execution and interpretation—this is, of course, by necessity: to propose a viable radical new bonding, mechanistic or reactivity model requires an approach to experimental work that is inspired, creative and rigorous.

*Modern papers:* There is much current research taking place in the field of organometallic chemistry, ranging from catalysis to energy research to new structures and bonding paradigms. Who knows where the future of the field lies.

**Discussion Expectations:** Each paper has an associated reading guide. These guides will be made available on Sakai in advance. This guide will help you get started reading the paper, but it is not an exhaustive guide everything in the paper. Each week, you should prepare your own individual (it is ok to work with others) answers to the reading guide questions. The purpose of the reading guide is to help you participate in a whole-class discussion of the paper each week. I expect you to have *mastered* the

material in the paper that is covered by the reading guide. That is, you should be prepared to participate in a discussion concerning any issue relating to the chemistry in question. This will almost certainly require going beyond the assigned paper (and in many cases, beyond any supplemental paper(s) provided) to other literature or textual sources, so you should get started preparing for your class early.

We will run the discussions using a Harkness diagram (see pdf on Sakai or on Wikipedia, https://en.wikipedia.org/wiki/Harkness_table). For each class, there will be two people assigned as scribes to summarize the class discussion. Everyone else will take their own notes on questions they have, answers provided, and corrections you want to make to your own answer sheet.

Scribe1: keep track of the discussion using a Harkness diagram and submit at the end of class
Scribe2: try to summarize the discussion in real time the best you can using bullet points/notes

The instructor will *not* participate in the discussion unless it is in danger of derailing or if incorrect conclusions are being drawn. I suggest that the class spend some time on a general discussion of the background concepts related to the paper. The majority of the time should be devoted to a more specific and in-depth discussion of the new concepts. Start with the reading guide questions, but good discussions will require going beyond what is in the provided documents.

At the end of class, you will turn in your original notes/answers to the discussion questions, as well as any corrections or additions you made during the class discussion. The two scribes will turn in their notes and diagrams. The diagram and notes will be made available on Sakai after class.

**Homework:** There will be occasional outside homework during the first few weeks to ensure you are keeping up with the material.

**Final Exam:** There will be a final *oral* exam that will be scheduled during a mutually agreeable time during finals week (before Friday 12/21 at noon). You will summarize and answer questions on a literature paper from the field of organometallics that we have not covered in class. The paper will be made available to you on the last day of class. The exam will take approximately 45 minutes.

**Executive summaries:** You are responsible for writing four 2-page "executive summaries" during the semester. Each summary will outline and convey the major points of the research article you read for that week. The audience for the executive summary is your research supervisor, who doesn't have time to read the literature but needs to be well-informed. More details on this assignment are provided on Sakai. Don't wait until the last 4 weeks of class to submit your executive summaries!

**Class Expectations:** I expect everyone in the class to have **studied** the assigned paper for each week. Note that my word choice is not arbitrary: do not merely *read* the paper—*study* it. To have studied a paper is to have *carefully* read it several times. Jot down notes and questions, doodle structures and count electrons as you read. Maybe draw a quick qualitative MO diagram. Think hard about what are the most important points of the paper, as well as its strengths and weaknesses (both of the science and of the writing). Be prepared and willing to actively participate in the class discussion.

**ASSESSMENT:** your grade in the class will be based on:

1. Active participation in class discussions/problem-solving exercises: **20 pts**
2. Reading guide submissions: **20 pts**
3. Homework problems: **20 pts**
4. Executive summaries: **20 pts**
5. Final exam: **20 pts**

TOTAL: **100 pts.**

The grade of B+ is yours to lose; here's how: don't take class seriously, don't prepare or participate in the discussion, turn in late homework, miss class, don't prepare for the final; don't show improvement on your executive summaries.

The grades of A- and A can be earned; here's how: be thoughtful, creative and insightful when you present information in class, actively participate in in-class discussions by asking and answering others questions, turn in well-reasoned and complete answers to problems, use the executive summaries to help you read and understand the papers, be *present* and *participate* in class.