

## Chemistry F602: Advanced Inorganic Chemistry, 3.0 Credits Spring Semester, 2009

Instructor: Dr. William A. Howard  
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Lecture Meetings: Monday, Wednesday, Friday, 9:15 AM – 10:15 AM, NSF 165  
Office Hours: By appointment

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**Required Text:** The Organometallic Chemistry of the Transition Metals, 4<sup>th</sup> Ed. Crabtree, R. H.; Wiley Interscience; Hoboken, NJ: 2005.

**Prerequisites:** Successful completion of Chemistry F402, Chemistry F322, and Chemistry F332 is required. Familiarity with molecular orbital theory and organic synthesis will also be necessary.

**General Information:** Advanced Inorganic Chemistry F602 is a 3.0 credit course intended for graduate students and advanced undergraduates. The course features organotransition metal chemistry and is taught on a graduate level. Students are expected to take the initiative in solving practice homework problems by themselves. There are two goals for this course: (1) the student will learn organometallic chemistry; and (2) the student will become an independent thinker.

A schedule of reading assignments is given at the end of this syllabus. Lectures will be conducted with the assumption that the student has read the textbook before coming to class. Not all of the material described in the textbook will be covered in each lecture; nevertheless, the student is responsible for all material described in the reading assignments.

**Examinations:** Three in-class examinations (close book and close notes) will be given, and each exam will be worth 100 points. There will also be a cumulative final examination (close book and close notes) worth 100 points. Each exam will consist of 10 – 15 problems, and many of these problems will be taken from the back-of-the-chapter problems given in the textbook.

**Make-up Exams and Absences:** If a student misses a class due to sickness, personal injury, bad weather, transportation problems, or a family emergency, then that student should notify Professor Howard as soon as possible, preferably BEFORE class. That student will receive an excused absence. Make-up exams and quizzes can be given for excused absences. Homework deadlines can be extended for excused absences. If the student does not notify Professor Howard within a week of the missed class period, then that student will receive an unexcused absence, regardless of the reason for missing the class. Make-up exams and quizzes will NOT be issued for unexcused absences, such

as sleeping too late, over-extended vacations, not being prepared, disputes with friends or acquaintances, or simply not coming to class.

**Article Presentations:** In order to become independent thinkers, students will be required to select and read three articles involving organometallic chemistry that have been published in 2008 or 2009 in either *Organometallics* or the *Journal of Organometallic Chemistry*. The student will then give a 30-minute PowerPoint Presentation on each article to the class. (See the Schedule at the end of this syllabus.) The student will present the published research and will then describe his or her own original ideas based on reading the published article. More information on these article presentations will be given.

**HyperChem Project:** One HyperChem project will be given to each student. The nature of the project depends on the first Article Presentation given by the student. More information on the HyperChem Project will be given later in the semester.

**Grades:** Grades will be assigned WITHOUT the +/- indicators and are determined as shown in the following table.

<b>Work to be Graded</b>	<b>Possible Points</b>
3 Examinations	3 x 100 points = 300 points
3 Article Presentations	3 x 50 points = 150 points
HyperChem Project	50 points
Final Examination	100 points
<b>Total</b>	600 points

Point Ranges and Letter Grades:	600 – 540	A
	539 – 480	B
	479 – 420	C
	419 – 360	D
	359 or less	F

**Academic Honesty:** The Chemistry “Department Policy on Cheating” is this: “Any student caught cheating will be assigned a course grade of F. The student’s academic advisor will be notified of this failing grade and the student will not be allowed to drop the course.”

Calculators may be used for numerical calculations only. Plan to use a non-programmable calculator for exams. Using qualitative chemical information or quantitative examples preprogrammed on a calculator is not allowed during exams. Prof. Howard reserves the right to give you a simple calculator if you bring a programmable device with you for an exam. Feel free to discuss this on an individual basis with Prof. Howard, well before exam time.

As a UAF student, you are subject to UAF’s Honor Code:

*“Students will not collaborate on any quizzes, in-class exams, or take-home exams that will contribute to their grade in a course, unless permission is granted by the instructor*

of the course. Only those materials permitted by the instructor may be used to assist in quizzes and examinations.

Students will not represent the work of others as their own. A student will attribute the source of information not original with himself or herself (direct quotes or paraphrases) in compositions, theses, and other reports.

No work submitted for one course may be submitted for credit in another course without the explicit approval of both instructors.

Violations of the Honor Code will result in a failing grade for the assignment and, ordinarily, for the course in which the violation occurred. Moreover, violation of the Honor Code may result in suspension or expulsion.”

**Instructor Withdrawal Policy:** The instructor reserves the right to withdraw a student from this course for any of the following reasons:

1. The student has missed exam 1 without an excused absence and has not attempted to make this exam up.
2. The student never attends class.

**Important Dates:**

- Last day to drop class with 100% refund Jan. 30
- Last day for withdrawals with class not appearing on record Feb. 6
- Last day to drop class with 50% refund Feb. 6
- Freshman Progress Reports due Feb. 27
- Spring Break Mar. 9 – 13
- Last day for withdrawals with student receiving “W” Mar. 27
- UAF Spring Fest Apr. 24
- Last day of class May 4

**More Important Information:** Students with documented disabilities who may need reasonable academic accommodations must provide documentation of the disability to Disability Services in the Center for Health and Counseling, 474-7043, TTY 474-7045. Disability Services will then notify Prof. Howard in writing of the disability and will advise on how the student should be tested and which accommodations should be made.

<b>Advanced Inorganic Chemistry F602: Schedule of Lectures</b>			
<b>Spring, 2009, Professor William A. Howard</b>			
<b>Week No.</b>	<b>Date</b>	<b>Reading</b>	<b>Classroom Lecture</b>
1	Jan 23	pp. 1-9.	Intro to course. Trans Effect, Soft and Hard Ligands.
2	Jan 26	pp. 9-15.	CFT and LFT
	Jan 28	pp. 16-27.	Backbonding, Electroneutrality, Ligand Types
	Jan 30	pp. 29-47.	Electron Counting, Valence, LBN
3	Feb 2	pp. 47-50.	Differences between metals, Outer sphere coordination
	Feb 4	Chapter 3.	Transition Metal Alkyl, Aryl, and Hydride Complexes

	Feb 6	Handouts.	Article Presentation by Dr. Howard
4	Feb 9	pp. 87-112.	Carbonyl, Phosphine Complexes, A and D Substitution
	Feb 11	pp. 112-120.	I Mechanism, Photochemistry, Steric and Solvent Effects
	Feb 13	Handouts.	Article Presentations by Ashley Anderson, Mary Ebadpour
5	Feb 16	pp. 125-148.	Alkene, Alkyne, Allyl, Diene, Cyclopentadienyl Complexes
	Feb 18	pp. 148-155.	Arene Complexes, Metallacycles, Complex Stability
	Feb 20		<b>Examination 1</b>
6	Feb 23	pp. 159-170.	SN2, Radical, Ionic Mechanisms, Concerted Reactions
	Feb 25	pp. 170-179.	Reductive Elimination, $\sigma$ Bond Metathesis
	Feb 27	Handouts.	Article Presentations by Spencer Giles, David Phillips
7	Mar 2	Chapter 7.	Insertions and Eliminations
	Mar 4		Nucleophilic Additions and Abstractions
	Mar 6		Electrophilic Additions, Abstractions, Radical Reactions
8	Mar 9		<b>Spring Break – NO CLASS</b>
	Mar 11		<b>Spring Break – NO CLASS</b>
	Mar 13		<b>Spring Break – NO CLASS</b>
9	Mar 16		Homogeneous catalysis with Alkenes
	Mar 18		Hydrocyanation, Hydrosilylation, and Hydroboration
	Mar 20		Article Presentations by Ashley Anderson, Mary Ebadpour
10	Mar 23		NMR Experiments
	Mar 25		IR and X-Ray Crystallography
	Mar 27		<b>Examination 2</b>
11	Mar 30		Carbenes, Carbynes, Metal-Ligand Multiple Bonds
	Apr 1		Alkene Metathesis, ROMP
	Apr 3		Article Presentations by Spencer Giles, David Phillips
12	Apr 6		C-H Bond Activation, CO and CO <sub>2</sub> Activation
	Apr 8		Syntheses and Structures of Organometallic Clusters
	Apr 10		Metal-Metal Bond Reactivity, Clusters, Nanoparticles
13	Apr 13		Alkyls, Aryls, and Hydrides in Organic Synthesis
	Apr 15		OM Reactions used in Organic Synthesis
	Apr 17		Article Presentations by Ashley Anderson, Mary Ebadpour
14	Apr 20		Paramagnetic Organometallic Compounds
	Apr 22		<b>Examination 3</b>
	Apr 24		<b>UAF Springfest – NO CLASS</b>
15	Apr 27		Vitamin B12 and Nitrogen Fixation
	Apr 29		Nickel Enzymes, Biomedical Applications
	May 1		Article Presentations by Spencer Giles, David Phillips

16	May 4		Article Presentation by Prof. Howard
	<b>May 8</b>	8:00 – 10:00 AM	<b>Final Examination</b>