

## CHEM 730: Inorganic and Organometallic Chemistry

Fall 2016

T/Th, 11:00am–12:15pm  
Room 514 Summerfield Hall

### Syllabus

**Instructor:** James Blakemore, Ph.D.  
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**Office hours:** Tuesday, 1:00-2:00pm, and other times by appointment

**Description from course catalogue:** An examination of the basic foundations of coordination chemistry and organometallic chemistry including symmetry methods, bonding, magnetism, and reaction mechanisms. Prerequisite: Two semesters of organic chemistry and one semester of physical chemistry in which quantum chemistry is introduced. The latter course may be taken concurrently with CHEM 730.

**Instructor's description:** CHEM 730 covers fundamental principles of inorganic chemistry, including theoretical foundations and interpretation of experimental data. We will endeavor to understand the role that electronic structure plays in the properties and reactivity of selected molecules and materials. Contemporary topics, including catalysis, metals in biology, and materials chemistry, will be discussed as time allows. In general, the course aims to build a foundation of organizing concepts to enable higher-level studies (and original research) in chemistry.

#### Primary Text (Required)

R. H. Crabtree, *The Organometallic Chemistry of the Transition Metals*, **2014**, 6th edition, Wiley, ISBN-13: 978-1118138076

#### Secondary Texts (Recommended; available on course reserve at Anschutz Library)

Gray, Harry B.; *Chemical Bonds: An Introduction to Atomic and Molecular Structure*, **1996**, 2nd edition, University Science Books, ISBN-13: 978-0935702354

Cotton, F. Albert; *Chemical Applications of Group Theory*, **1990**, 3rd edition, Wiley-Interscience, ISBN-13: 978-0471510949

Shriver, Weller, Overton, Rourke, and Armstrong; *Inorganic Chemistry*, **2014**, 6th edition, W. H. Freeman and Co., ISBN-13: 978-1429299060

#### Grading

Periodic Table Quiz (1 x 10%; 50 pts)  
Midterm Exams (2 x 20%; 100 pts each; 200 pts subtotal)  
Final Exam (30%; 150 pts)  
Problem Sets (3 x 5%; 25 pts each; 75 pts subtotal)  
In-class Quizzes and Participation (25 pts)  
Total: 500 points

## Exams

There will be three exams (two midterms and one final). Midterm exams will be administered in the usual class period, and will cover all material presented to-date. The final exam will be administered during the scheduled final-exam period, and will be comprehensive.

Midterm I: **Tuesday, September 27, 2016**

Midterm II: **Tuesday, November 1, 2016**

Final Exam: **Friday, December 16, 10:30am–1:00pm**

For more information: <https://registrar.ku.edu/exams>

## Periodic Table Quiz

An understanding of the periodic table is among the great achievements in chemistry. Instant recall of the organization of the periodic system vastly accelerates scientific discussion in chemistry, and prepares students for use of chemistry in a variety of settings. Students will be quizzed on the location of all elements in the *s*, *p*, and *d* blocks in an in-class quiz, i.e., a blank chart will be handed out and students will fill in the location of the elements. The quiz will take place at the beginning of the class period on **Tuesday, August 30, 2016**.

## Problem Sets

Four will be assigned throughout the semester, based on textbook reading, lecture content, and outside sources that may be required. Your solutions to these problems will be due in class on the specified “due dates.” ***Absolutely no late sets will be accepted.*** Students are encouraged to work together on solving the problems, including discussion of the problems and their possible solutions. However, do not copy solutions from others.

## Lecture Material

Some lectures will emphasize topics not covered in the suggested texts, or discussed in a different context. The time sequence of the presentation of certain topics will develop naturally based on in-class discussions and student questions. ***Therefore, it is highly recommended that students attend all lectures and take notes.***

## Course website

All students enrolled in CHEM 730 have been granted access to the Blackboard site for this course. Be sure you are able to access this site to view information pertaining to this course, including electronic handouts, problem sets and answer keys, course announcements, important links, etc. You will be prompted for your KU Online ID and password to access these materials. If you have any trouble accessing the course website, contact the instructor immediately.

## Academic Integrity

We expect that all students will maintain the highest standards of personal, academic, and scientific integrity. The study of science is worth little unless findings are reported accurately and proper authorship is attributed.

From the KU Student Handbook:

“The following policy . . . defines a uniform approach to acts of academic misconduct involving students in courses offered by the KU College of Liberal Arts and Sciences (CLAS). Academic integrity requires the honest performance of academic responsibilities by students. Academic responsibilities include, but are not limited to: the preparation of assignments, reports, and term papers; the taking of examinations; and a sincere and conscientious effort by students to abide by the policies set forth by instructors. ***Any subversion or compromise of academic integrity thus constitutes academic misconduct.*** Examples of misconduct include (among others) falsification, unauthorized assistance or plagiarism or reports, term papers, research papers, or other written documents; giving or receiving unauthorized aid on examinations; disruption of classes; and the offering of gratuities or favors in return for grades.”

Any incidents of academic misconduct will be prosecuted to the fullest extent possible within the scope of University policies, as described in the Student Handbook that is available at the website quoted above. At a minimum, this will include receiving zero credit for the work in question for any party involved. Additional penalties may include a grade of “F” for the entire course as well as suspension or expulsion from the University. If you have any questions about what constitutes academic misconduct, please consult with the instructor or the Student Handbook.

For more info on this issue, including charges and sanctions:

<https://college.ku.edu/sites/clas.ku.edu/files/docs/Policies/Faculty/clas-student-academic-misconduct-2009-04.pdf>

## Course Evaluation

Both the University and the instructor value effective teaching. Although student evaluations are only one component of an effective teaching assessment strategy, they are an important component and must be given due consideration by both students and faculty. The Department of Chemistry now implements **online student-evaluation surveys** instead of paper surveys.

Surveys will be administered via Blackboard, and are configured such that student anonymity is guaranteed. Students will receive an email from the KU Center for Online and Distance Learning with instructions for completing the survey in Blackboard. Students can only access the survey once, and reminders will be sent to those who have not completed the survey. The survey period is Sunday-Sunday of the last week of classes (ending just before finals week). ***Students will be provided time during a class period to complete the electronic course evaluation.***

A full description of procedures is found in the KU Policy Library at:

<http://policy.ku.edu/provost/student-eval-procedures-for-admin>.

## **Statement on Diversity, Equity, & Inclusion**

*Language borrowed in part from the KU College of Liberal Arts and Sciences*

Our vision is to provide an environment for learning and working where differences are valued and each person in the College community is supported and offered an equitable opportunity to achieve their academic and professional goals. An equitable and safe multiracial, multiethnic, and multicultural environment produces innovative thinking, research, and learning. Moreover, an open, equitable, and supportive academic environment builds on everyone's strengths to speed our advance toward the creation of new knowledge. Along this line, we observe some guiding principles:

- Diversity. We are committed to providing an environment where differences strengthen our entire community and provide the foundation for equitable opportunities and successful outcomes for all. Our definition of “diversity” encompasses acceptance and respect for each other. We are multiracial, multiethnic, and multicultural and we recognize there are inequalities and privileges generated by those differences, including race, ethnicity, gender, sexual orientation, socio-economic status, age, physical abilities and religious beliefs. By affirming the complexities of our histories, cultures, and experiences, we move toward a fuller understanding of each other and ourselves.
- Equity. We are committed to policies, processes, practices, and programs that appreciate difference and create fair, safe, and just learning, working, and living environments for students, staff, and faculty.
- Inclusion. The instructor is committed to providing a context in which all students, staff, and faculty, receive respect and opportunity for intellectual growth and professional development, regardless of social, cultural and economic background and experience.

**Special Needs**

The Academic Achievement and Access Center (AAAC) coordinates accommodations and services for all students that are eligible. If you have a disability for which you wish to request accommodations and have not yet contacted the AAAC, please do so as soon as possible. Their office is located in 22 Strong Hall, and the phone number is (785) 864-4064 (V/TTY). Information about their services is available at <http://disability.ku.edu>. Please contact the instructor privately regarding any accommodations needed in this course.

**Commercial Note-Taking Ventures**

Pursuant to the University of Kansas' Policy on Commercial Note-Taking Ventures, commercial note-taking is not permitted in this course. Lecture notes and course materials are provided for personal use in mastering the course material; these materials may not be sold to any person or entity in any form. Any student engaged in or contributing to the commercial exchange of notes or course materials will be subject to discipline, including academic misconduct charges, in accordance with University policy. Please note: note-taking provided by a student volunteer for a student with a disability, as a reasonable accommodation under the ADA, is not the same as commercial note-taking and is not covered under this policy.

For more information:

<http://policy.ku.edu/provost/commercial-note-taking>

**Course Materials**

Prepared course materials and delivered lectures are the property of the instructor. Video and audio recording of any lecture without instructor's consent is prohibited. On request, the instructor may grant permission for students to record lecture audio; this will be on the condition that the specific individual use the recordings only as a study aid. Unless explicit permission is obtained from the instructor, electronic copies of any course-related materials may not be transmitted or transferred to any other person, regardless of whether or not that individual is enrolled in the course.

**CHEM 730, Fall 2016**  
***Inorganic and Organometallic Chemistry***  
**Lecture Topics and Calendar**

<b>Week</b>	<b>Topic</b>	<b>Related Reading</b>	<b>Dates (no. lectures)</b>
<b><i>Molecular and Electronic Structure</i></b>			
1	Atomic Theory Periodic Trends, Lewis Structures	Gray, Ch. 1 Gray, Ch. 2	23 Aug (1) 25 Aug (1)
2	Valence Bond Theory	Shriver, pp. 39-42	30 Aug (1)
3	Molecular Orbital (MO) Theory	Gray, Ch. 3	1,6,8 Sept (3)
<b><i>Symmetry and Group Theory</i></b>			
4	Operations, Point Groups, Character tables	Cotton pp. 1-67	13,15 Sept (2)
5	Symmetry and MO Theory	Gray, Ch. 4	20, 22 Sept (2)
<b>EXAM 1</b>	<b>Tuesday, 27 Sept</b>		
<b><i>Transition-Metal Chemistry</i></b>			
6-8	Coordination complexes, isomers Ligand field theory and magnetism Spectroscopy		
<b><i>Reactivity of Coordination Complexes</i></b>			
9	Ligand substitution reactions Electron-transfer reactions		
<b>EXAM 2</b>	<b>Tuesday, 1 Nov</b>		
<b><i>Organometallic Chemistry and Advanced Topics</i></b>			
10-15	18-electron rule and common ligands Carbonyl complexes; electronic structure and reactivity Pi-bonding ligands; electronic structure and reactivity Special ligand types (hydrides, alkyls) Catalysis Chemistry of the <i>f</i> -elements		
<b>FINAL EXAM</b>	<b>Friday, 16 Dec, 10:30am-1:00pm</b>		