

CHEM 660: Systematic Inorganic Chemistry

Spring 2017

M/W/F, 12:00-12:50pm, 1003 Malott Hall

Syllabus

Instructor: James Blakemore
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Office hours: Wednesday, 1:00-2:00pm, and other times by appointment

Description from course catalogue: A systematic study of the elements and their compounds, emphasizing the relationship between properties of substances and their atomic and molecular structures, and the positions of the elements in the periodic systems. Prerequisite: CHEM 510 or CHEM 530. Satisfies: Natural Science (N).

Instructor's description: CHEM 660 explores the basis of the field of inorganic chemistry, including the relevant theoretical models and the interpretation of experimental data. Using principles developed in course content, we will endeavor to understand the role that electronic structure plays in the properties and reactivity of selected molecules and materials. Selected advanced topics (e.g., catalysis, chemistry of the f-elements, chemistry of the main-group elements) will be discussed. In general, the course aims to build a foundation of organizing concepts that will be helpful in higher-level studies and original research in chemistry.

Primary Texts (Required; 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

Crabtree, Robert H.; *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)

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)
Final Exam (25%; 125 pts)
In-Class Participation (5%; 25 pts)
Problem Sets (4 x 5%; 25 pts each)
Total: 500 points

Exams

There will be three exams, two midterms and one final. Midterm exams will be administered during the usual class period, and will cover all material presented to-date. These midterms may have a take-home component. The final exam will be administered during the scheduled final-exam period, and will be comprehensive.

Midterm I: **Friday, 17 February 2017**

Midterm II: **Friday, 31 March 2017**

Final Exam: **Wednesday, 10 May 2017; 10:30 am – 1:00 pm**

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 **Monday, January 23, 2017**.

Problem Sets

Four sets will be assigned throughout the semester, based on textbook reading, lecture content, and outside sources. Your solutions (show your work!) 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 may emphasize topics not covered in the primary or secondary texts, or could discuss topics in a context not provided in the texts. Additionally, the time sequence of the presentation of certain topics will evolve 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 660 have been granted access to the Blackboard site for the course. Please ensure that you can access the site, as it will be the platform for distribution of electronic handouts, problem-set 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.

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>. *All arrangements for special needs must be set well in advance of exam administration or problem set distribution to ensure fairness to all students.*

Course Evaluation

Both the University and the instructor value effective teaching. Student evaluations are an important component of teaching assessment, and the instructor places strong emphasis on feedback provided by students. The Department of Chemistry uses online student-evaluation surveys instead of paper forms.

Surveys in this course 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>.

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.”

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

<https://college.ku.edu/undergrad/students/policies>

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.

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.

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>

Statement on Diversity and Inclusion

As a premier international research university, the University of Kansas is committed to an open, diverse and inclusive learning and working environment that nurtures the growth and development of all. KU holds steadfast in the belief that an array of values, interests, experiences, and intellectual and cultural viewpoints enrich learning and our workplace. The promotion of and support for a diverse and inclusive community of mutual respect require the engagement of the entire university.

CHEM 660 – Spring 2017
Systematic Inorganic Chemistry
 Course Calendar

Week	Date	Topic	Related Reading
<i>Atomic and Molecular Structure</i>			
1	18 Jan 20 Jan	Atomic Theory Periodic Trends, Bonding Models	Gray, Ch. 1 Gray, Ch. 2
2	23 Jan 25 Jan 27 Jan	Molecular Orbitals of Diatomic Molecules Symmetry	Gray, Ch. 3, Shriver, pp. 39-42 Gray, Ch. 4
<i>Symmetry and Group Theory</i>			
3	30 Jan 1 Feb 3 Feb	Symmetry Elements Operations Assigning point groups	Cotton pp. 1–67
4	6 Feb 8 Feb 10 Feb	Character tables and their applications Infrared absorption spectroscopy	
5	13 Feb 15 Feb 17 Feb	Symmetry and molecular orbitals Exam 1	
<i>Electronic Structure: Ligand Field Theory</i>			
6	20 Feb 22 Feb 24 Feb	Ligands and complexes; CBC method Electron counting Symmetry and molecular orbitals	Crabtree, Ch. 1 and 2 Gray, Ch. 5
7	27 Feb 1 Mar 3 Mar	Axial symmetry	
8	6 Mar 8 Mar 10 Mar	Geometric distortions Electronic absorption spectroscopy	
9	13 Mar 15 Mar 17 Mar	Synthesis and structure of ferrocene LFT for ferrocene Ligand substitution reactions	Crabtree Ch. 4
10	20 Mar 24 Mar 26 Mar	Spring Break – No Lectures – –	
11	27 Mar 29 Mar 31 Mar	Exam 2	

Organometallic Reaction Chemistry

12 3 Apr Oxidative addition & reductive elimination **Crabtree Ch. 6**
 5 Apr Reactions II **Crabtree Ch. 7 and 9**
 7 Apr

13 10 Apr Catalysis
 12 Apr
 14 Apr

Chemistry of the f-Elements

14 17 Apr General properties **Shriver Ch. 23, pp. 623-657**
 19 Apr Bonding

Chemistry of Main-Group Elements

 21 Apr General considerations
15 24 Apr Compounds and bonding

Special Topics

 26 Apr Hydrides and hydrogen chemistry
 28 Apr Metal-ligand multiple bonds; carbenes **Crabtree Ch. 11**
16 1 May Chemistry of nitrogen fixation
 3 May Final Review

 4 May *Thursday, Last day of classes for Spring 2017*

17 10 May **Comprehensive Final Exam (Exam 3), 10:30am–1:00pm, Wednesday**