

Drexel University
Molecular Symmetry and Group Theory
CHEM 420
Winter 2016 Syllabus

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CLASS SCHEDULE

Lecture:	T Th 2:00 – 3:20 pm	Pearl 303
Office Hours:	M 2:00 – 4:00 pm Th 11:00 am – 1:00 pm Also available by appointment	Stratton 410 Stratton 410

COURSE OBJECTIVES

- To understand how structure and bonding influence the physical properties and reactivity of inorganic molecules.
- To be able to use crystal field theory to understand the electronic and magnetic properties of transition metal complexes.
- To be able to use symmetry to predict molecular orbital diagrams and explain electronic spectra.
- To gain an appreciation for how inorganic chemistry influences your everyday life.

Note – CHEM 421 is the pre-requisite for CHEM 420. Junior chemistry majors follow CHEM 421 with CHEM 420 in the winter term (either the same year or the next year), with CHEM 422 and CHEM 425 taken in the spring of your Senior year.

COURSE MATERIALS

Required:

- Vincent, A. *Molecular Symmetry & Group Theory 2nd ed.*; Wiley, 2001.
 - available as a 2-hour loan via Hagerty Reserves
- Any molecular model kit that can build linear, trigonal planar, tetrahedral, trigonal bipyramid, and octahedral structures

Other Useful Texts:

- Housecroft, C. E.; Sharpe, A. G. *Inorganic Chemistry 4th ed.*; Pearson, 2012. ISBN: 978-0-273-74275-3.
 - 3rd edition available in the library
- Atkins, et al. *Shriver & Atkins Inorganic Chemistry 5th ed.*; Freeman, 2010.
 - available as a 4-hour loan via Hagerty Reserves
- Lawrence, G. A. *Introduction to Coordination Chemistry*, Wiley, 2010.
 - available as a hardcopy and as an electronic resource via Hagerty Library
- Miessler, G. L.; Tarr, D. A. *Inorganic Chemistry 3rd ed.*; Pearson, 2004.
 - available as an overnight loan via Hagerty Reserves

Web:

The “Drexel Learn” course website will be used extensively throughout the course. Lecture notes, course announcements, homework assignments and solutions, and exam information will be regularly posted. Emails will also be sent to your Drexel email account. Students are responsible for checking the course website and email on a regular basis.

COURSE EXPECTATIONS**Lecture:**

Lecture will primarily be conducted through PowerPoint lectures as well as through worked examples on the board, in-class demonstrations, and in-class activities. The PowerPoint lectures will be posted on the course website, typically immediately following class. Though lecture is the major portion of the course, students must also refer to outside material to gain a full understanding of the curriculum. Relevant readings for most of the topics can be found in any inorganic textbook. The Vincent text is very useful for the MSGT portion of the course.

Attendance:

Although an attendance grade will not be given in this course, you are expected to attend all lectures. If you do miss class, be sure to go over the corresponding PowerPoint slides and consult a fellow classmate for any additional notes given in class. You are also expected to arrive on time and remain to the end of class. Arriving late or leaving early puts the student at a disadvantage as well as interrupts the rest of the class. If you must arrive late or leave early, please notify me beforehand.

Homework Problem Sets:

Five homework sets will be assigned throughout the term. Regular work on problems is *ESSENTIAL* to your mastery of the topics presented in CHEM 420. You are encouraged to discuss these problems with me at our mutual convenience, as well as with your classmates, though final work turned in for grading must be your own. Due-dates for homework assignments are included in the syllabus. Assignments are typically due by 11:59 pm on the date indicated, and can be submitted by hand or through the BbLearn course website. **Late homework assignments will result in a deduction of 5% per day. Homework will not be accepted once assignments have been returned, or answer keys have been posted.**

Assignments will be posted on the course website at least one week prior to the due date. Problem sets will be graded mostly on effort, but the instructor reserves the right to choose a few questions at random for grading based on performance. Answer keys will be posted on the course website once the assignment has been returned. Be sure to go over the key so that you learn from your mistakes prior to an exam! Each student will have the lowest homework score dropped. In-class assignments may also be given during the term at the discretion of the instructor. These assignments will be graded and included in the “homework” portion of the course.

Exams:

There will be two one-hour exams during the semester and a 2-hour comprehensive final exam. The exam dates for the in-class exams can be found on the class schedule at the end of the syllabus. The date, time, and place of the final exam will be announced later in the term so **do not make any travel arrangements until you know your final exam schedule.** All exams, including the final, will be closed book. If you miss an in-class exam, a make-up exam will be given at the end of the term (date, time, and place of the make-up exam are TBA). You do not need an excuse to take the make-up if you miss an in-class exam, but you *MUST* attend the make-up or receive a score of zero. You may make-up only one exam, and only because of an absence. **NO MAKE-UP EXAMS WILL BE GIVEN FOR THE FINAL EXAM!**

Americans with Disabilities Act:

Students requesting accommodations due to a disability at Drexel University need to present a current Accommodation Verification Letter (AVL) to faculty before accommodations can be made. AVL's are issued by the Office of Disability Resources (ODR). For additional information, visit the ODR website at <http://www.drexel.edu/oed/disabilityResources>, or contact the Office for more information: [215-895-1401](tel:215-895-1401) (V), or disability@drexel.edu

Electronic Devices:

Students may use computers, laptops, and electronic tablets to follow along with the lecture notes. The use of computers, laptops, and electronic tablets for ***any other purposes***, as well as the use of cell phones, iPods, mp3 players etc., will be ***strictly prohibited*** during class! If students are unable to abide by these rules, all electronic devices will be prohibited!

GRADING

Tentative grade cutoffs are shown below. The instructor reserves the right to lower some or all of the grade cutoffs.

Final Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F
%	100-93	92-90	89-87	86-83	82-80	79-77	76-73	72-70	69-67	66-65	Below 65

The grading rubric for the course is as follows:

Homework	15%
In-class Exams	50%
Final Exam	35%

Academic Honesty:

Drexel University is committed to a learning environment that embraces academic honesty. In order to protect members of our community from results of dishonest conduct, the University has adopted policies to deal with cases of academic dishonesty. Please read, understand, and follow the academic policies on Academic Dishonesty located at http://www.drexel.edu/provost/policies/academic_dishonesty.asp.

Add, Drop And Withdrawal Policies:

- You can **add** this course until the end of week 2
See http://www.drexel.edu/provost/policies/course_add.asp
- If you add this course after the start of the term, you are responsible for completing ALL work that you may have missed.
- You can **drop** this course until the end of week 2; the course will then be removed from your transcript – See http://www.drexel.edu/provost/policies/course_drop.asp
- The course **withdrawal** deadline is February 19th. You will have received some graded work prior to this deadline. If you have any questions about your progress at any time of the term, please contact me. If you choose to Withdraw, a “W” will be recorded in your transcript
See http://www.drexel.edu/provost/policies/pdf/course_withdrawal.pdf

TENTATIVE SCHEDULE

The instructor reserves the right to change the schedule of topics, readings, homework assignments, etc., if necessary. Appropriate advance notice will be given by in-class announcement and on the course website. The dates of in-class exams and the final exam will not change.

Week	Lecture Dates	Lecture Topics	Notes
1	T 1/5 Th 1/7	<ul style="list-style-type: none">• X-ray diffraction and transition metal ion electron configuration review• Bond Valence Sum Theory	
2	T 1/12 Th 1/14	<ul style="list-style-type: none">• Symmetry elements and groups: combination, matrix usage, and characters	
3	T 1/19 Th 1/21	<ul style="list-style-type: none">• Symmetry elements and groups: combination, matrix usage, and characters continued• Reducible and irreducible representations• Character tables• Mullikan Notation	<i>HW 1 due T 1/19</i>
4	T 1/26 Th 1/28	<ul style="list-style-type: none">• Crystal Field Theory• O_h fields, spectrochemical series, Jorgensen's f & g values	
5	T 2/2 Th 2/4	<ul style="list-style-type: none">• <i>Exam 1 Review</i>	<i>HW 2 due M 2/1</i> Exam 1 Th 2/4
6	T 2/9 Th 2/11	<ul style="list-style-type: none">• CFS other than O_h: T_d fields, 4d and 5d ions, planer/D_{4h} symmetry, Jahn-Teller distortion• Magnetism	
7	T 2/16 Th 2/18	<ul style="list-style-type: none">• Symmetry approach to atomic orbitals and molecular orbitals• MO theory for transition metal complexes	<i>HW 3 due Th 2/18</i>
8	T 2/23 Th 2/25	<ul style="list-style-type: none">• Introduction to electronic spectra of transition metal complexes including: d-d transitions, ligand π to π^* transitions, LMCT, MLCT, selection rules, Tanabe and Sugano diagrams	
9	T 3/1 Th 3/3	<ul style="list-style-type: none">• Electronic spectra continued• <i>Exam 2 Review</i>	<i>HW 4 due M 2/29</i> Exam 2 Th 3/3
10	T 3/8 Th 3/10	<ul style="list-style-type: none">• Introduction to Vibrational Spectroscopy• <i>Final Exam Review</i>	<i>HW 5 due Th 3/10</i>
11		FINAL EXAM: Date, Time, and location TBA	