Goals of the Course

This course is meant to cover topics in modern structural chemistry, particularly inorganic chemistry. This area is sometimes called “theoretical inorganic chemistry”. As such, it deals with chemistry in terms of theoretical models of structure and bonding. The models chemists have used to describe structure and bonding have varied over the years, with some dropping away and others persisting in spite of more sophisticated understanding. The older models that persist tend to do so, not because they are particularly “correct”, but because they are convenient to the task at hand. Therefore, it is very important that we, as chemists, understand at all times the strengths and limitations of the particular models we are using. The primary goal of this course is to give you that understanding. While we will be discussing structure and bonding of particular molecules on the basis of one or more models, it is important to remember that the only observable is the electron density, not the constructs of the models (e.g., bonds, electron pairs, hybrid orbitals, molecular orbitals). Those constructs are merely convenient ways of rationalizing and organizing the observable electron density within the context of the chosen model. It is my hope that this course will disabuse you of many of the common misconceptions chemists tend to acquire from losing sight of the distinction between models of reality and reality itself.

General Information

1. This course meets Monday and Wednesday evenings in room S/1/089 (Chemistry Conference Room). It is scheduled for 5:30 - 6:45, but I would like to move our start time to 5:00, if possible.

2. The two texts for the course are Ronald J. Gillespie and Paul A. Popelier, Chemical Bonding and Molecular Geometry, Oxford University Press, 2001, and Robert L. Carter, Molecular Symmetry and Group Theory, John Wiley and Sons, 1998. Both should be available in the bookstore or on-line. We will begin with the Gillespie and Popelier book, switch to my book, and then come back to the Gillespie and Popelier text. The sequence of chapters in each text is indicated in the Syllabus (separate document).

3. A good model kit is essential for this course. Most kits designed for organic chemistry are inadequate, because (a) they take too much time to assemble, (b) they obscure symmetry relationships, and (c) they have limited (if any) kit parts to show coordination above CN4. The best model kit for our purposes is the Prentice-Hall Framework Molecular Model Kit (ISBN 0133311765), which consists of four-, five-, and six-pronged jacks and a variety of
colored plastic straws. If you currently have another model kit that allows for higher coordination (CN5 and CN6), do not spend the money for this one. However, if you need a kit, check the college bookstores around town or try to order the Prentice-Hall kit online.

4. Please feel free to drop by my office (the department chair’s office) at any time you need to discuss something about the course. (Note: I am seldom in my regular faculty office, S/1/128, so don’t look for me there.) On Mondays and Wednesdays I will be on campus from mid-morning (~10:00 am) until the end of class. On Tuesdays I have a Chem 130 lab from 10:00 to 1:00. Although you can drop into the lab to see me there, if necessary, please wait until sometime after 10:30. I will generally not be available after 1:00 on Tuesdays, and I will not be on campus on Thursdays. On Fridays I plan on being on campus by 7:00 until at least noon. If you have trouble connecting with me, send email to ask a question or to set up a time we can meet.

Grades

Grades will be based on graded homework (35%), a mid-term exam (25%), a final exam (25%), and in-class participation (15%). Each of these is explained in more detail below.

1. **Homework.** I will assign homework problems more or less on a weekly basis. You will have at least one week to complete the assignment. All homework is due at the beginning of our Wednesday meetings. Your answers must be neatly and legibly written, and work leading to the final results must be shown for problems involving more than simple answers. *You may discuss the assigned problems with other students, but the work that you turn in must be your own.* Copying another student's work is plagiarism, which at the very least will receive zero credit, and if flagrant could result in serious disciplinary action.

Late homework will be penalized 10% per day (including weekends). If you must turn in an assignment late, either give it to me personally in my office (not while passing me in the hallway) or put it in my mailbox in the Chemistry Department office. In the latter case, have a faculty member or staff member sign and date your homework. **Never slip any homework or other written material under my door!** For your own protection and study purposes, I strongly urge you to make copies of your homework assignments before turning them in.

2. **Exams.** The mid-term and final exams may have both in-class and take-home components. If either exam has a take-home component, you will have at least a week to complete it. No **consulting with any person or resource is allowed on any exam, whether in-class or take-home, unless otherwise specified.** No late papers will be accepted for any take-home exam, except in cases of genuine sickness or emergency, subject to appropriate verification.
3. **Class Participation.** You should come to each class session having read the appropriate sections in the book covering the topic, and you should be prepared to discuss the topic of the day. I may occasionally ask students to explain a point to the rest of the class, particularly when we are discussing assigned homework. My evaluation of your regular preparedness throughout the course will form the basis of this portion of your grade.

**Assumed Background**

In keeping with the graduate level, we will assume that you have had most if not all of the requirements for a bachelor’s degree in chemistry. This course makes use of topics that are normally introduced in the quantum mechanics portion of physical chemistry and the theoretical portions of advanced inorganic chemistry. Nonetheless, since backgrounds vary widely, we will review essential topics to be sure everyone is starting at the same level. If you find you lack the appropriate background for any topic, I can suggest some books to use for review. Much of the early material should be review, but we will generally delve into each topic in more depth and breadth eventually. Aside from chemistry, I will assume that all students have the mathematical background necessary for physical chemistry. Previous exposure to matrices, although desirable, is not essential.