

# Chemical Bonding (CH411/511) Syllabus

## Instructor

Mark Woods

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## Office Hours

I run no system of formal office hours. If you would like to speak with me about the course then either: catch me after class; drop by my office (SB2 328, I am usually there on all day Thursday and Friday); or drop me an e-mail and we can arrange an appointment.

## Overview

The purpose of this course is to provide students with a picture of the fundamental concepts of chemical bonding. The course is broken down into three sub-courses, each focusing on an important aspect of chemistry of bonding. The first two sub-courses will have their own exam, in addition to the final exam. The final will cover material from the entire course.

## Texts

The choice of texts will be discussed in detail in the first class. I have required the purchase of two texts that are excellent for the study of the most fundamental aspects of the course: "Chemical Bonding" by Mark J. Winter and "Introduction to Molecular Symmetry" by J.S. Ogden. You should not expect that these texts will cover all the material in sufficient detail to pass the course it is recommended that you find additional texts. I will recommend some on the first day of class but you should certainly consider a general Inorganic Chemistry textbook of your own liking. You need not necessarily buy these additional books, the library should have some that can be borrowed.

## Course Structure

As mentioned above this course will be divided into three discrete sub-courses: Atomic and Molecular Orbitals; Group Theory; Non-covalent Bonding. Homework assignments will be required for each class. The homework assignments will be reviewed and discussed in class on Mondays and the completed work assignment will be due at 5 PM on the Friday prior. Assignments that arrive late will most likely be returned ungraded. There will be a graded treasure hunt part way through the course. Students studying CH 511 will be expected to undertake an additional assignment over and above those required for CH 411. Near the end of the course the students will be required to present to the

class on one of the non-covalent binding topics. Topics will be assigned at least 2 weeks in advance.

**Topics:**

***Atomic and Molecular Orbitals***

- Structure of an atom
- Quanta
- Orbitals and probability density
- Building a molecular orbital
- MO diagrams in diatomics
- MO diagrams in polyatomics
- VESPR theory
- Bond orders

***Group Theory***

- Symmetry Operations
- Point groups
- Relationship of symmetry to MOs
- Effects of symmetry in spectroscopy
- Other important aspects of molecular symmetry

***Non-covalent Bonding***

- Ionic bonding
- Metallic binding
- Bonding in solids
- Dative bonding

**Teaching Schedule**

<b>Week 1 (27<sup>th</sup> Sept – 1<sup>st</sup> Oct)</b>		
Monday	<b>ATOMIC AND MOLECULAR ORBITALS</b>	
	Lecture	Work handed-out
Wednesday	Lecture	
Friday	Lecture	
<b>Week 2 (4<sup>th</sup> Oct – 8<sup>th</sup> Oct)</b>		
Monday	Work Review	Work handed-out
Wednesday	Lecture	
Friday	Lecture	
<b>Week 3(11<sup>th</sup> Oct – 15<sup>th</sup> Oct)</b>		
Monday	Work Review	
Wednesday	Lecture	
Friday		<b>MID TERM</b>
<b>Week 4 (18<sup>th</sup> Oct – 22<sup>nd</sup> Oct)</b>		
Monday	<b>GROUP THEORY</b>	

	Lecture	Work handed-out
Wednesday	Lecture	
Friday	Lecture	
<b>Week 5 (25<sup>th</sup> Oct – 29<sup>th</sup> Oct)</b>		
Monday	Work Review	Work handed-out
Wednesday	Lecture	
Friday	Lecture	
<b>Week 6 (1<sup>st</sup> Nov – 5<sup>th</sup> Nov)</b>		
Monday	Work Review	
Wednesday		Treasure hunt
Friday	Lecture	
<b>Week 7 (8<sup>th</sup> Nov – 12<sup>th</sup> Nov)</b>		
Monday	Lecture	Work handed-out
Wednesday	Lecture	
Friday		<b>MID TERM</b>
<b>Week 8 (15<sup>th</sup> Nov – 19<sup>th</sup> Nov)</b>		
Monday	Work Review	
Wednesday	<b>Non-covalent Bonding</b>	
	Lecture	Work handed-out
Friday	Lecture	
<b>Week 9 (22<sup>nd</sup> Nov – 26<sup>th</sup> Nov)</b>		
Monday	Work Review	Work handed-out
Wednesday	Lecture	
Friday		<b>Thanksgiving</b>
<b>Week 10 (29<sup>th</sup> Nov – 3<sup>rd</sup> Dec)</b>		
Monday	Work Review	
Wednesday	Lecture	
Friday	Lecture	
<b>Finals Week (6<sup>th</sup> Dec – 10<sup>th</sup> Dec)</b>		
Wednesday		<b>FINAL EXAM</b>

### Student Assessment During the Term

- You will be assessed on three exams, two midterms and a final. Your grade for the term will be determined entirely by your performance in these three exams. CH412 students each Mid term will contribute 30% to your overall grade, the treasure hunt 10% and the final the remaining 30%. CH512 students each Mid term will contribute 25% to your overall grade, the treasure hunt 10%, the presentation 10% and the final the remaining 30%
- Class homework will be graded but does not contribute to your grade for the term, it is only for the purposes of providing student feedback
- Completion of course homework **is compulsory**. Failure to submit homework on time will result in a 5% reduction in your grade on the next exam.

- All work, exams and other assignments will be graded on the basis that a clean sheet of paper affords zero marks. For every correct answer you provide you will be awarded marks. Marks are not 'taken off', they must be earned.

### **The Small Print**

- Your attendance at class is not compulsory; however, you should expect that your absences will be reflected in your performance in the exams.
- If you miss class you should seek help from your fellow students before coming to see me. I do not intend to re-teach classes on a regular basis.
- You should make plans to attend **ALL** exams. Attendance at exams is compulsory.
- If you cannot make an exam then it must be for an acceptable reason. Acceptable excuses would include: bereavement, illness and religious holidays.
- If you miss an exam for an acceptable reason or for illness then your term grade will be made up from your score on the other exams.
- If you miss an exam for an unacceptable reason, then you will be awarded a zero.
- I expect that students will conduct themselves in a courteous and considerate manner in class: cell phones off, no discussing last night, *etc.* If you are not interested in the class, then please do not attend in the first place.
- Any part of this syllabus is subject to change without notice by the instructor.