

Structure, Bonding, and Reactivity

Based on atomic orbital theory, how many electrons can occupy an orbital?

CHEM-3523

Fall 2019

Purpose: This course investigates and applies wave-mechanical models of bound electrons to account for the electronic structure of atoms and how its' used to explain the similarities/differences in the behavior of various elements in the periodic table. Following is the building of numerous molecular systems in the application of Molecular Orbital Theory with Group theory and interpreting/predicting their electronic properties and chemical reactivity (kinetics and mechanisms).

Learning Outcomes: Each student will acquire a basic understanding of the quantum mechanical view of multi-electron atoms and use this as a basis to build molecular systems, via *Valence Bond Theory*, *Molecular Orbital Theory* and *Group Theory*. The student will be able to generate qualitative orbital energy diagrams for various molecular systems in such a manner that allows one to predict the electronic behavior and chemical reactivity.

Instructor:	Dr. Slattery
Phone:	(678) 839-6016
Email:	sslatt@westga.edu (You must use your MyUWG address)
Office Hours:	MW (1:00 – 5:00 pm); F (10:00 – noon); Room (2128)
Class Meetings:	Tues. & Thurs. (11:00 - 12:20 pm):
Location:	TLC Building (Room 2105)
Text:	Reading Material will be provided; however, it is strongly recommended to use <i>General Chemistry, Organic, Inorganic, Physics, and Physical Chemistry texts as supplements to this course.</i>

Evaluation: Your *course grade* will be computed as shown below.

	Percent of Total
A (90 - 100%); B (80 – 89%); C (70 – 79%); D (60 – 69%)	
*Exam #1 (Atomic Structure, Periodic Trends, Valence Bond Theory)	22.5%
*Exam #2 (Molecular Orbital Theory & Group Symmetry)	22.5%
*Exam #3 (Interaction between Light & Matter)	22.5%
*Exam #4 (Organic and Inorganic Reaction Intermediates and Transition States)	22.5%
Home-Work	10.0%
Total	100%

Examinations

There will be four examinations along with homework assignments. The date of each test will be announced approximately 7 – 10 days in advance. ***Cheating will not be tolerated. Any infraction will be taken before the disciplinary committee.***

University Policies

Please refer to the following for academic support, the honor code, email policy, credit hour policy and HB 280 (Campus Carry Policy):

<https://www.westga.edu/administration/vpaa/common-language-course-syllabi.php>

CORRESPONDENCE

Please use your “myUWG” or “CourseDen” e-mail account for all written communication. E-mails from other service providers (aol, gmail, hotmail, yahoo) will be ignored.

Tentative list of Topics to be covered!

I. Atomic Structure

- A. Particle (Bohr) & Wave Mechanical Model of Single Electron Systems*
- B. Wave Mechanical Approximation of Multi-electron Systems*
- C. Periodic Trends based on Wave Mechanical Model*
- D. Spectroscopic Term Symbols (ground vs excited state)-*

II. Valence Bond Theory (Review material from Freshman & Organic Chemistry)

- A. Lewis Dot Structure (geometry, resonance, & formal charge)*
- B. Valence Shell Electron Pair Repulsion Theory and Valence Bond Theory*
- C. Electronegativity & Bond Polarity*

III. Molecular Orbital Theory

- A. Valence Bond Theory vs Molecular Orbital Theory*
- B. Molecular Orbital Theory applied to Homo- and Hetero-Diatomic Systems*
- C. Molecular Orbital Theory applied to Triatomic Systems*

IV. Group Symmetry applied to Molecular Orbital Theory

- A. Symmetry Elements, Operators, & Character Tables*
- B. Molecular Orbital Energy Diagrams for Triatomic Systems*
- C. M.O. Energy Diagrams beyond Triatomic Systems*
- D. Spectroscopy & Selection Rules (the peculiar behavior of matter!)*
- E. Photo-Physics*

V. Chemical Reactions

- A. Kinetics and Mechanisms*
- B. Pericyclic Reactions*
- C. Woodward-Hoffman Rules.*
- D. Photochemistry*