

Chemistry 501 : Advanced Inorganic Chemistry (3 credits) Spring 2016

Monday, Wednesday, Friday 10:10-11 am in Fulmer 150

Syllabus

Instructors: Prof. Paul Benny Fulmer 639C 509-335-3858 bennyp@wsu.edu
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Office Hours: SW: Tuesday 10-11 am, Wednesday 11-12 am; or by appointment

Website: The course website and gradebook will be maintained in BlackBoard (<http://learn.wsu.edu/>)

Required Text: Housecroft and Sharpe Inorganic Chemistry, 4th Ed. (ISBN : 978-0273742753)

Recommended Resources: These texts listed below may provide useful explanations, but are not required for the course. Many of the topics discussed can be found in standard inorganic texts and specific references will be provided by the individual instructors. Selections from a variety of "classical" (many-out-of-print) inorganic chemistry resources will be provided as necessary.

Inorganic Chemistry, Miessler and Tarr (ISBN : 978-0321811059)

Inorganic Chemistry, Shriver and Atkins (ISBN : 978-1429299060)

Chemistry of the Elements, Greenwood and Earnshaw (ISBN : 978-0750633659)

Advanced Inorganic Chemistry, Cotton and Wilkinson (ISBN : 978-0471199571)

Student Learning Outcomes

Chemistry 501 is designed to advance students toward the WSU Learning Goals, especially Scientific Literacy, Critical and Creative Thinking, Quantitative Reasoning, Communication, and Information Literacy. This course will provide graduate students and senior undergraduates with a foundation in the theoretical principles and the descriptive chemistry of the elements of the periodic table. The objective is to introduce the concepts of symmetry, bonding, oxidation-reduction, molecular structure, and acid-base chemistry, then to use this framework to understand the chemistry of the elements, with a focus on the d- and f-block transition metals. The level of the course assumes an entering graduate student with a B.S. in Chemistry with some experience with the topic of inorganic chemistry.

By the end of the course it is expected that every student will:

- 1) Be able to predict the ideal geometry of a molecule and determine the point group symmetry.
- 2) Be able to derive a molecular orbital diagram for a molecule and to use the diagram to aid in the prediction of the chemical behavior.
- 3) Be able to use unit cell descriptions of ionic structures and describe the basis for their stability.
- 4) Be able to apply acid/base theories to the description of chemical reactions.
- 5) Be able to describe transition metal coordination compounds in terms of their geometry and interpret at a basic level their electronic properties.
- 6) Have the basic knowledge of the descriptive chemistry of the element families to be able to read, understand, and communicate about the current chemical literature.

- 7) Be able to propose a plausible reaction mechanism for a chemical transformation from experimental rates laws and patterns of chemical reactivity.
- 8) Be able to describe the bonding and general patterns of stability in organometallic compounds.
- 9) Be able to describe the basis for catalytic cycles using organometallic catalysts.
- 10) Demonstrate an understanding for some of the roles of metal ions in biology and medicine.
- 11) Demonstrate an understanding of the properties of the lanthanides and actinides as they are distinguished from the transition metals.

Assessment: All learning goals are assessed through problems sets and exams. The schedule of the topics is indicated below.

Work load: As with all courses, this course is designed to require at least 2 hours outside of class for every hour of class.

Grading Scheme:	Problem Sets (Best 5 of 7)	100 pts	(bi-weekly)
	Midterm Exams (2)	200 pts	(Feb. 26 th , and April 18 th in class)
	Final Exam	200 pts	(Monday, May 2nd 8:00-10:00 am)

Grade Ranges: 500-450 pts A, 449-400 pts B, 399-350 pts C, 349-300 pts D, 299-0 pts F, +/- grades may also be used.

Assignments

Problem sets: The problem sets will be assigned bi-weekly on Monday and be due the following Monday at the start of class. Late problem sets will not be accepted. There will be seven problem sets, with five counting towards the final grade (the two lowest scores will be dropped).

Problem Set Due Dates: Problem Set #1 – January 25th, Problem Set #2 – February 8th, Problem Set #3 – February 22nd, Problem Set #4 – March 7th, Problem Set #5 – March 28th, Problem Set #6 – April 11th, Problem set #7 – April 27th

Exams: There will be two midterm exams given during class time (Friday, February 26 and Monday, April 18) and a comprehensive during Finals Week (Monday, May 2). All exams will be short answer. You will be responsible for bringing a calculator and a pencil to all exams. No notes or books or other electronic devices are allowed, including cell phones or any device with headphones. No make-up exams will be given. If you are unable to take a scheduled exam for documented academic reasons beyond your control, you will be allowed to schedule the exam at an earlier time.

Tentative Course Schedule:

Wk	Date	Topic	Textbook	Exams/ Problem sets
1	Jan. 11 -15	Atoms, orbitals, and periodic trends	Ch. 1	
		Bonding models: Lewis, valence bond and molecular orbital	Ch. 2	
		Polyatomic molecules	Ch. 5	
2*	Jan. 21-23	Symmetry and point groups	Ch. 3	
3	Jan. 25-29	Inorganic spectroscopy	Ch. 4	Jan. 25, P.S. 1
		Solid state structures	Ch. 6	
4	Feb. 1 – 5	Acid/base chemistry	Ch. 7	
5	Feb. 8 – 12	Nonaqueous solvents	Ch. 9	Feb. 8, P.S. 2
		Oxidation/reduction	Ch. 8	
6#	Feb. 17 - 19	Oxidation/reduction	Ch. 8	
7	Feb. 22 -26	Coordination Chemistry	Ch. 19	Feb. 22, P.S. 3 Feb. 26, Exam 1
8	Feb. 29 – Mar. 4	Electronic spectra of metal complexes	Ch. 20	
9	Mar. 7 – 11	Electronic spectra of metal complexes	Ch. 20	Mar. 7, P.S. 4
	Mar. 14 – 18	Spring Break		
10	Mar. 21 - 25	Inorganic reaction mechanisms	Ch. 26	
11	Mar. 28 – Apr. 1	Organometallics (PB)	Ch. 24	Mar. 28, P.S. 5
12	Apr. 4 – 8	Catalysis (PB)	Ch. 25	
13	Apr. 11 – 15	Bioinorganic (PB)	Ch. 29	Apr. 11, P.S. 6
14	Apr. 18-22	Lanthanides and Actinides (KN)	Ch. 27 and handouts	Apr. 18, Exam 2
15	Apr. 25 – 29	Lanthanides and Actinides (KN)	Ch. 27 and handouts	Apr. 27, P.S. 7
Finals	May 2	Final Exam Monday, 8—10 am		

* Martin Luther King Day, Jan. 17

President's Day Class Holiday, Feb. 15

Students with Disabilities: Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; Phone: 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center (335-3417 <http://accesscenter.wsu.edu>, Access.Center@wsu.edu)

Academic Integrity: We encourage you to work with classmates on assignments. However, each student must turn in original work. No copying will be accepted. Students who violate WSU's Standards of Conduct for Students will receive an F as a final grade in this course, will not have the option to withdraw from the course, and will be reported to the Office Student Standards and Accountability. Cheating is defined in the Standards for Student Conduct WAC 504-26-010 (3). It is strongly suggested that you read and understand these definitions.

Safety and Emergency Notification: Washington State University is committed to enhancing the safety of the students, faculty, staff, and visitors. It is highly recommended that you review the Campus Safety Plan (<http://safetyplan.wsu.edu/>) and visit the Office of Emergency Management web site (<http://oem.wsu.edu/>) for a comprehensive listing of university policies, procedures, statistics, and information related to campus safety, emergency management, and the health and welfare of the campus community.

Assigning Incompletes: University policy (Acad. Reg. #90) states that Incompletes may only be awarded if: "the student is unable to complete their work on time due to circumstances beyond their control".

Important Dates and Deadlines: Students are encouraged to refer to the academic calendar often to be aware of critical deadlines throughout the semester. The academic calendar can be found at <http://registrar.wsu.edu/academic-calendar/>.