

# Chemistry 4610

## Inorganic Chemistry

### Spring 2020



**Instructor:** Dr. Martin R. McPhail  
**Office:** TLC 2129    **Lab:** TLC 2108  
**Phone #:** (678) 839-6019 (Office)  
                  (678) 839-6550 (Chemistry Department)  
**E-mail:** mmcphail@westga.edu  
**Office Hours:** M/Tu 1:00 pm - 5:00 pm  
                  F 9:30 am – 11:30 am  
                  \*\*and by appointment

### Course Information

**Class:** Chem 4610 (CRN 10205 - 3 credit hours)  
**Meeting Time:** Tu/Th 11:00 am – 12:15 pm  
**Room:** TLC 2105

### Course Description

The wave nature of electrons is applied to atomic structure and periodic trends. Inter and intramolecular bonding models are used to interpret the chemical and physical properties of various materials, from simplistic diatomic molecules to structurally complex molecular and ionic systems. Thermodynamic principles are used to determine the relative stability of inorganic compounds.

### Required Textbook:

Housecroft and Sharpe, *Inorganic Chemistry* 5<sup>th</sup> ed. Pearson, 2018.

### Other Recommended Texts for Further Reading:

Weller, Overton, Rourke, and Armstrong, *Inorganic Chemistry* 7<sup>th</sup> ed. Oxford University Press, 2018.

Miessler, Fischer, and Tarr, *Inorganic Chemistry* 5<sup>th</sup> ed. Pearson, 2013.

### Learning Outcomes

1. Students will apply models of atomic structure and chemical bonding to explain the physical properties and reactivities of inorganic systems.
2. Students will critically read the chemical literature to understand how the scientific method has been applied to answer research questions in inorganic chemistry.
3. Students will synthesize chemical results and communicate them in their own words to peers.
4. Students will relate principles of inorganic chemistry to modern technological challenges.

## Course Assessment

Students' progress towards mastery of the learning outcomes will be tracked and assessed via:

### **Lecture Attendance [Outcome 1, 2, 4]**

Lectures will develop key concepts from fundamental principles and apply them to topics in inorganic chemistry, so **lecture attendance is mandatory**. Arriving to class **more than ten minutes late** will result in you being counted as absent. You will be allowed **two free absences** without a point reduction. Additional absences will result in a point loss *except* in the case of an emergency where **official documentation** can be provided. Powerpoint slides will be made available prior to each lecture to facilitate preparation and note taking. Recording of lectures is permitted.

### **Homework [Outcome 1, 2, 4]**

Homework allows for the reinforcement of key concepts and feedback between student and instructor. Homework will be assigned on a weekly basis through CourseDen and will be **due at the beginning of class** as indicated on the schedule. All work must be shown to receive full credit for the assignment.

### **Journal Articles [Outcome 2, 3, 4]**

Keeping up-to-date with a rapidly evolving profession requires you to read journal articles critically for understanding of key concepts, methods, and results. Unfortunately, the format of scientific articles often makes this a serious challenge to the uninitiated. To practice this skill, you will be assigned a series of articles accompanied by worksheets to guide your reading. Each worksheet should be completed prior to the date listed on the schedule; time will be spent in class on discussion of the article. Your worksheet answers and participation in group discussion will constitute the grade for this component.

### **Literature Review Project [Outcome 2, 3, 4]**

As a professional in the sciences, you will be routinely called upon to synthesize the literature of a given topic to create a picture of the current state of the field and the directions it is moving in. To practice this skill, you will analyze a set of related papers published in the past few years by a prominent researcher in the field.

You will write a five-page, double-spaced written review of the chosen set of articles. You should include a brief introduction to the research topic in general, a description of the techniques and methods used in the papers you read, a discussion of the common themes and findings between your sources, and an outlook on the future directions of the topic. This summary should be clear, concise, and written to introduce a peer to the topic. Remember that good review articles provide *connections* and *perspective*.

**Topic Choice** – Five topics relevant to modern inorganic chemistry have been selected by your instructor. For each topic, a prominent researcher in the field has been chosen along with three of their recently published articles. You will choose one of these topics and base your paper around the associated articles. There will be a limit to five students per topic choice.

**Outline** - You will complete an outline template that organizes the pertinent information of your three articles into the form of a review paper.

**First Draft** - This needs to be a **complete** written draft of your paper following the same guidelines as used for the final draft. Your first draft will be reviewed by your instructor as well as one of your peers.

**Final Draft** - Your final draft will be due on the last day of class. The final draft will be graded for content, structure, perspective, and incorporation of feedback.

### **Midterm Exams [Outcome 1]**

Three, 75-minute midterm exams will be given that include a mixture of multiple choice, short answer, and worked problems. These will not be comprehensive, so Exam 2 will not cover material tested on Exam 1. **Non-graphing calculators** are permitted, but calculator applications on phones, tablets, laptops, or other electronic devices are **not** permitted.

### **Final Exam [Outcome 1]**

The ACS Inorganic Chemistry Exam will be given as the final exam for this course at the time specified by the UWG Registrar. This comprehensive exam is comprised of 60 multiple choice questions that will need to be completed in 110 minutes. A **non-graphing calculator** is allowed on this exam.

### **Grading Scale**

A	90 – 100
B	80 – 89
C	70 – 79
D	60 – 69
F	0 – 59

### **Assessment Weighting**

Attendance	5 %
Homework	15 %
Articles	10 %
Lit. Review	10 %
Midterms	15% each; 45 % total
Final Exam	<u>15 %</u>
	100%

## Course Policies and Information

### 'Curving' Policy

In the event that the average exam grade falls below 75%, exam grades will be adjusted or 'curved' using a linear scale to ensure an average exam grade of 75% and maximum exam grade no higher than 100%.

### Extra Credit Policy

No extra credit will be accepted for this course

### Late Assignment & Make-up Policy

Late assignments will receive a 10% point deduction per day late (e.g. an assignment due at 12:30 pm on Monday and turned in at 3:00 pm on Tuesday will receive a 20% point deduction). Make-up assignments and exams will only be possible in the case of a documented emergency, and you should contact me within 24 hours if such an emergency arises. Make-up assignments should be completed and turned in within one week of the original deadline unless this is not allowed by the nature of the emergency. Arrangements for make-up exams will be made between myself and the student.

### **Student Conduct**

Students are obligated to abide by conduct guidelines as described in the university catalog. Respect and courtesy of all students while in the classroom is required. The following are also mandatory:

1. Any disruptive behavior will result in your expulsion from the room. If disruptive behavior persists you will receive a minimum of a one letter-grade deduction from your overall grade as well as possible additional action depending on the severity of the behavior.
2. All electronic devices must be silenced during lecture. Calls may only be answered in the case of emergencies by stepping out into the hall. Headphones are not permitted to be worn during lecture. **Laptops and tablets are permitted**, but if your use of these devices becomes disruptive their use will be disallowed for the remainder of the semester.

Please feel free to contact me with any questions regarding the above. Following "common sense" behavior should prevent any of the above problems. Failure to adhere to conduct guidelines could result in *dismissal from class, a course grade deduction, as well as further disciplinary action.*

### **University Policies and Academic Support**

Please review the Common Language for all university course syllabi at the address: <https://www.westga.edu/UWGSyllabusPolicies/> . This document contains important information regarding Academic Support, Online Courses, Honor Code, Email Policy, Credit Hour Policy, and HB 280 (Campus Carry). You should regularly review these statements because they are updated as federal, state, university, and accreditation standards change.

**Academic Honesty**

Any form of academic dishonesty—including but not limited to cheating or plagiarism—will result in a failing grade on the relevant assignment as well as possible additional action. Please be familiar with the definitions of academic dishonesty and plagiarism as laid out in the Student Handbook, which can be found at the link: <http://www.westga.edu/handbook/>

**Disabilities Act / Accessibility for the Course**

If you are a student with a disability as defined under the Americans with Disabilities Act and require assistance or support services, please notify me and provide me with a copy of your packet from Student Services. The university will provide you with resources for any audio/visual needs that you may have with the learning management system or course content.

It is critical that you contact UWG Accessibility Services immediately to find out what accommodations are necessary so we can work together to facilitate your success in this class. Please consult the UWG Accessibility Services site <http://www.westga.edu/accessibility> or call (678) 839-6428 for more details regarding accessibility for this course.

**Note on Syllabus Modifications**

I reserve the right to modify this syllabus at any time during the course of the term, particularly with regards to course schedule. Students will be notified of all syllabus modifications. In a case where a substantial modification is required, I will reissue a revised syllabus.

## Tentative Course Schedule

Month	Day	Lecture Topics	Reading	Assignments
Jan	7 Tu	History of Atomic Theory		
	9 Th	Mass Spectrometry/Early Quantum	1.1 - 1.6, 4.5	
	14 Tu	Quantum Theory	1.7 - 1.10, 4.12	HW 1
	16 Th	Simple Bonding Theory	2.1, 2.2, 2.4 - 2.8	<i>Article 1</i>
	21 Tu	Symmetry & Point Groups	3.1 - 3.5	HW 2
	23 Th	Applications of Symmetry	3.6 - 3.8, 4.6	<b>Topic Choice</b>
	28 Tu	Principles of Valence Bond & Molecular Orbital Theory	2.3, 2.7, 5.1 - 5.4	HW 3
	30 Th	Ligand Group Orbitals; Structures of Metals	5.5, 5.6, 6.1 - 6.7	<i>Article 2</i>
Feb	4 Tu	Structures of Ionic Solids	6.10 - 6.12, 6.18, 4.11	HW 4
	6 Th	<b>Exam 1</b>		
	11 Tu	Bonding in Solids	6.8 - 6.9, 6.13 - 6.16	
	13 Th	Water, Acids/Bases, and Solubility	7.1 - 7.10	<i>Article 3</i>
	18 Tu	Coordination and Redox Equilibria	7.11-7.13, 8.1 - 8.3	HW 5
	20 Th	Redox and Non-aqueous Media	8.4-8.5, 9.1-9.13	
	25 Tu	Coord. Compd Structure	2.9, 19.6 – 19.8	HW 6
	27 Th	Coord. Compd Bonding Theory	20.1 - 20.5	<b>Outline</b>
March	3 Tu	LS Coupling	20.6, 20.11 - 20.13	HW 7
	5 Th	Electronic Spectroscopy	20.7 - 20.9	<i>Article 4</i>
	10 Tu	Magnetic Properties	20.10, 4.9	HW 8
	12 Th	<b>Exam 2</b>		
	17 Tu	<b>NO CLASSES</b>		
	19 Th	<b>NO CLASSES</b>		
	24 Tu	Ligand Substitution Kinetics	26.1 - 26.4	
	26 Th	Charge Transfer Kinetics	26.5	<b>First Draft</b>
	31 Tu	Organometallics – Bonding	24.1 - 24.5, 4.8	HW 9
April	2 Th	Organometallics - Reactivity	24.8 - 24.11	<i>Article 5</i>
	7 Tu	Organometallics - Reactivity	24.12 - 24.15	HW 10
	9 Th	Homogeneous Catalysis	25.1 - 25.6	<b>Peer Review</b>
	14 Tu	Heterogeneous Catalysis	25.7 - 25.9	HW 11
	16 Th	Bioinorganic Chemistry	29.1 - 29.3	<i>Article 6</i>
	21 Tu	Bioinorganic Chemistry	29.4 - 29.5	
	23 Th	<b>Exam 3</b>		
	28 Tu	<i>Reading Day</i>		<b>Final Draft</b>