

**Chemistry 425: Inorganic Chemistry I**  
**Fall 2023**

**Instructor:** Matt Cain

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**Office Hours:** MTWRF 8:00-9:00 am or by appointment, Bilger 321C

**Text:**

*Inorganic Chemistry*, 5<sup>th</sup> Edition, Miessler and Tarr

Other useful textbooks:

*Organometallics*, 3<sup>rd</sup> Edition, Elschenbroich

*The Organometallic Chemistry of the Transition Metals*, 6<sup>th</sup> Edition, Crabtree

(PDFs of the older additions are available online and/or you can borrow the book from me for a few hours or so)

**Grading:**

4-5 Exams, ~100 pts each

**EACH EXAM IS APPROXIMATELY 2 HOURS.**

**YOU WILL HAVE TO FIND A 2 HOUR BLOCK DURING THE DAY TO TAKE THE EXAM.**

HW and assignments → 10-20 pts each (drop lowest) = 1 Exam (of lowest points)

**Topics/Chapters:**

**Introduction: Fundamental Knowledge** (Sources: Literature Articles)

*Historical Significance and Future Goals, Trends and Hard-Soft Acid Base Theory, Bent's Rule and Phosphorus, and Ligands: Cone and Bite Angles*

**Chapter 9: Coordination Chemistry I: Structures and Isomers**

*History, Nomenclature, Isomerism, Coordination Numbers and Structures, MOFs, Counterions, terminology and concepts*

**Chapter 10: Coordination Chemistry II: Bonding**

*Evidence for electronic structures, crystal field theory, ligand field theory, angular overlap, Jahn-Teller Effect*

**Chapter 11: Coordination Chemistry III: Electronic Spectra**

*Absorption of Light, Quantum numbers of multielectron atoms, electronic spectra of coordination compounds*

**Chapter 12: Coordination Chemistry IV: Reactions and Mechanisms**

*Background, Substitution Reactions, Kinetic Consequences of Reaction Pathways, Experimental Evidence of Octahedral Substitution, Stereochemistry of Reactions, Substitution reactions of Square Planar Complexes, trans effect, ox-red reactions*

## **Chapter 6: Acid-Base and Donor-Acceptor Chemistry**

*Arrhenius Concepts, Bronsted-Lowry, Lewis Acid-Base, Intermolecular Forces, HSAB Theory*

## **Chapter 13: Organometallic Chemistry**

*Background, organic ligands, 18-electron rule, ligands, bonding between metal atoms and  $\pi$ -systems, M-C bonds, spectral analysis*

## **Chapter 14: Organometallic Reactions and Catalysis**

### **Learning Outcomes:**

1. Acid/base theory and the concepts of soft/hard acids/bases,
2. The preparation, structure, and spectroscopic properties of coordination compounds, and
3. The basics of organometallic chemistry

### **Suggestions:**

Come to class. I will not take attendance or give pop quizzes, but coming to class will be critical to doing well in the class. I may say things like "You need to know this," i.e., this is probably going to be on the exam. You are adults, and I will treat you as such. Come to class, do your work, and you will do fine. If you cannot do the minimum of showing up, I will have no sympathy for you.

I will mostly shuttle between powerpoint slides and the blackboard. Therefore, I would print out the powerpoint slides (perhaps 4-6 to a page if you want to save paper/ink) and write on them. Having paper handy will also make it quick and easy to write with me as I discuss concepts on the blackboard.

You may notice that on my powerpoint slides, I cite an extensive amount of published research. You DO NOT need to read these papers, but you may be interested in the chemistry and therefore, I am providing you an excellent, often recent source to explore. If you want to read the papers, by all means read, this is how you learn, and there is an abundance of extremely smart and creative chemists out there that you should know.