

# CHEM 3320.001

## Inorganic Chemistry

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RBS 2015, TR 8:00—9:20 AM

Dr. Jason Smee

Contact Info

• [jsmee@uttyler.edu](mailto:jsmee@uttyler.edu)

• 903.566.7069

• RBS 3030

Howdy (Office) Hours

• MWF 10:30-12:00 pm

• or by appointment

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### Course Description

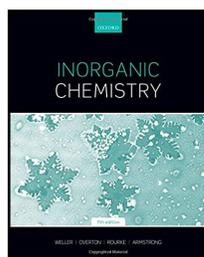
This is an introductory inorganic chemistry course, which will focus on basic areas such as periodic trends, coordination chemistry, kinetics and mechanisms of inorganic reactions, simple bonding theories, and solid-state inorganic chemistry. A more complete list of topics is shown later in the syllabus. Fundamental topics from General Chemistry will also be reviewed and expanded in the context of inorganic chemistry. (IF time permits, we may also cover the often overlooked area of lanthanoid/actinoid chemistry).



*"I think chemistry is being frittered away by the hairsplitting of the organic chemists; we have new compounds discovered, which scarcely differ from the known ones and when discovered are valueless—very illustrations perhaps of their refinements in analysis, but very little aiding the progress of true science."*

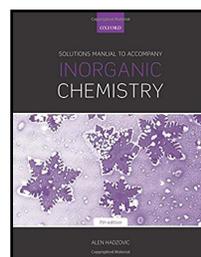
— Michael Faraday (ca. 1845)

### Required & Recommended Materials



The **required** text is *Inorganic Chemistry 7/e* by Weller et al. ISBN-13: 9780198768128.

(6/e acceptable, some chapter numbers have changed)



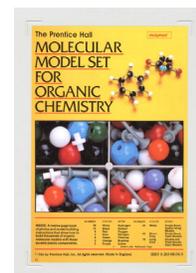
The *Solutions Manual to Accompany Inorganic Chemistry 7/e* is **recommended**, but not required. ISBN-13: 9780198814689.



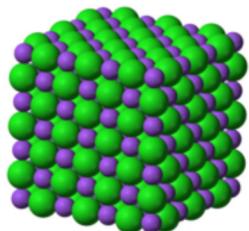
A scientific calculator (capable of exponents and logarithms) is **required**.



Achieve homework account is **required**. Cheapest option is to purchase online. See page 3 for details.



An organic/inorganic model kit (a common example is shown at left) is **recommended**, but not required. If you purchase one, make sure at least two of the atoms are six-coordinate.



Structure of NaCl represented as a series of green (Cl) and purple (Na) spheres.

*"Chlorine is a deadly poison gas employed on European battlefields in World War I. Sodium is a corrosive metal which burns upon contact with water. Together they make a placid and unpoisonous material, table salt."*

~ Carl Sagan



## Student Learning Outcomes

By the end of this course, students should be able to

- 1) correctly name inorganic compounds (both main-group and coordination compounds)
- 2) describe, identify, and draw the various isomers commonly formed by coordination compounds
- 3) utilize bonding theories to predict the effects of charge, electron configuration, and the types of ligands on the structure and reactivity of coordination compounds
- 4) calculate crystal field stabilization energies and magnetic moments from electron configurations
- 5) describe and/or calculate the properties of various types of crystal lattices
- 6) predict and identify periodic trends such as effective nuclear charge, the inert pair effect, the uniqueness principle, and the diagonal effect

## Canvas

I will utilize Canvas to post the following items

- 1) syllabus
- 2) lecture notes & recorded lectures
- 3) due dates for Sapling homework assignments
- 4) grades (my Excel grade book is the official grade book)
- 5) links to tutorial videos
- 6) links to interesting websites



## Course Requirements

- 1) CHEM 1312/1112 (General Chemistry II and Lab) is a pre-requisite.
- 2) CHEM 3121 (Inorganic Chemistry Lab) is required to fulfill degree requirements; if CHEM 3320 is taken as an elective then the lab is not required.
- 3) CHEM 3342/3143 (Organic Chemistry I and Lab) is helpful, but **not required**.
- 4) We meet TR from Jan 11 to April 21 at 8 am in RBS 2015 (except Spring Break). **Synchronous** Zoom for first 2 weeks only.
- 5) You must take the final exam to pass the class.

## Attendance!

- I will take attendance in this class by sign in sheet (and Zoom login for the first 2 weeks for those quarantining). Participate!!!!
- The more you participate, the more you will get out of class!
- *Each exam will have a review session **IF** class attendance is  $\geq 75\%$  for the days that exam's material covers. Otherwise **NO REVIEW** session and you will need to come to my office to ask questions on exams.*

## Grading

- The official gradebook is the Excel file on my desktop computer (in case Canvas gets messed up).
- Achieve assignments will be shown on Canvas.
- Grades will be tentatively based on a 90/80/70 scale, but may be adjusted based upon my evaluation of the class's overall performance.

Online Homework	20%
3 "In-class" exams	60%
Cumulative final exam	20%
<b>Total</b>	<b>100%</b>

## Homework (20% of course grade: 5% in class, 15% Achieve)

There will be short, group in-class assignments that make up 5% of your grade.

The other 15% of the homework portion will be assigned through the Macmillan Achieve platform (\$47). Don't panic! I promise it is MUCH easier than in Analytical.

- Homework will be assigned for each chapter and will be due 5 days after finishing the chapter's material. This class meets Tuesday and Thursday, so due dates are either Sundays or Tuesdays.
- All assignments will be posted on Canvas. Please try to complete homework assignments on time. Microsoft Edge may not work with Achieve; you may want to try other browsers (Chrome, Firefox, etc.). Mobile devices don't play well with Achieve; desktop computers, laptops, or tablets are recommended.
- I will PROBABLY (no guarantees) set up a virtual Zoom "office" hour on the evening homework is due for homework questions, but I will be asleep well before the actual deadline to submit the homework.
- Do not buy "USED" Achieve access codes, they probably won't work!

### To enroll in the Achieve section for this course follow the steps below

- Navigate to the Achieve Access Module on Canvas and click on Achieve Home to connect your Canvas and Achieve Accounts.
- Follow these [instructions](#) for help connecting Achieve through Canvas.

### Other helpful links

- [Disable browser pop-up blockers](#) and refer to the [troubleshooting guide](#) if you experience any difficulty accessing Achieve.
- Browse [Achieve: Getting Started Guide for Students](#)
- Contact [Macmillan Customer Support](#)



## Exams (60% of course grade for midterms; 20% for final exam)

- The three, in-class midterm exams are worth 60% of your overall grade. They will be mostly short answer/calculation questions and some multiple choice. I'll inform you where each exam's material will be cut off one week in advance.
- The final exam will be an ACS Nationally Standardized exam. The final is 20% of your grade and is required to pass the class.
- Missed exams due to an unexcused absence will result in a grade of zero. In the event of an excusable situation, please give me 2+ days' notice to schedule an alternate time.

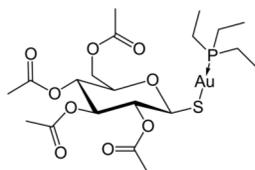


**Alfred Werner**  
**"Father of**  
**Coordination**  
**Chemistry"**  
**1913 Chemistry**  
**Nobel Prize**

*"Will fluorine ever have practical applications? It is very difficult to answer this question... A scientific research is a search after truth, and it is only after discovery that the question of applicability can be usefully considered."*

— Henri Moissan, discoverer of F<sub>2</sub>





Auranoftin™ is a gold compound used to treat arthritis. It is one of only a handful of FDA-approved, metal-based drugs.

*“Poison is in everything, and no thing is without poison. The dosage makes it either a poison or a remedy.”*  
~ Paracelsus,  
16<sup>th</sup> century alchemist



As<sub>2</sub>O<sub>3</sub> while toxic has been shown to be therapeutically useful in the treatment of acute promyelocytic leukemia.

## Important Dates (Note: midterm exam dates are tentative; final exam date is fixed)

- January 24 (Monday): Census Date; last day to file for grade replacement
- **February 8 (Tuesday): Exam 1**
- March 1 (Tuesday): FINAL day to apply for Spring graduation
- March 7–11 (M – F): Spring Break, no classes
- **March 24 (Thursday): Exam 2**
- March 29 (Monday): Last Day to Drop with a “W”
- **April 19 (Tuesday): Exam 3**
- **April 26 (Tuesday): Final Exam, 8:00 am – 10:00 am in RBS 2015**

## Topics to Be Covered (listed by chapter in the textbook, 7/e)

- Chapter 5.1 – 5.16: Acids and Bases (Skip sections 5.5, 5.8, 5.11, and 5.17)
- Chapter 7: Introduction to Coordination Chemistry (nomenclature, structures, isomers, formation constants, and chelate effect)
- Chapter 20.1 and 20.8-20.9: Electronic Structure (Crystal Field Theory, spectrochemical series, Crystal Field Stabilization Energies, magnetic moments, Jahn-Teller effect, and magnetic coupling)
- Chapter 21 + outside material: Coordination Chemistry Reactions (reaction types, ligand substitution reactions/mechanisms, and redox reactions)
- Chapter 27 + outside material: Medicinal Inorganic Chemistry (treatment of cancer, arthritis, bipolar disorder, and HIV; chelation therapy and imaging agents)
- Chapter 4 + outside material: Structure & Energetics of Simple Solids (unit cells, alloys, salts, lattice energies, Born-Haber cycles and defect structures); Band Theory; Semiconductors
- Chapter 9 + outside material: Periodic Trends (radii, EN, IE, EA, uniqueness principle, diagonal effect, and inert pair effect)
- Chapter 10: Hydrogen & Hydrides (production, reactions, types of hydrides)
- Chapters 11–18: Selected topics related to main group elements (especially borohydrides and cluster chemistry in Group 3A)
- Chapter 6.1-6.4, 6.9, 6.12-6.14: Redox Chemistry (Latimer, Frost, & Pourbaix diagrams)
- Chapter 3.1: Symmetry Operations, Elements, and Point Groups
- Chapter 23: The *f*-block elements (lanthanides and actinides, time permitting)

## Top 10 Reasons to Study Inorganic Chemistry\*

10. There's more to the periodic table than the first 3 rows.
9. The COLORS...Oooooo...
8. Gloveboxes give you an excuse to say “Smell my finger...”
7. What's just one more ligand...?
6. I'm just one reaction away from discovering a room-temperature superconductor...I swear...
5. Octahedral geometries are easier to draw.
4. COT has more bite!
3. Something about “nano”...
2. Carbon is over-rated.
1. I know how to count higher than 8!



\*List taken from [https://www.cafepress.com/mf/13342360/top-10-reasons-to-study-inorga\\_tshirt?productId=69337098](https://www.cafepress.com/mf/13342360/top-10-reasons-to-study-inorga_tshirt?productId=69337098)

## Special Note about This Semester's Course

I have been chosen to participate in a study as part of the VIPER Fellows Project. VIPER stands for **V**irtual **I**norganic **P**edagogical **E**lectronic resources, a group of college and university educators dedicated to improving Inorganic Chemistry teaching.

As part of the VIPER Fellows project I will be video recording myself teaching 4 lectures on solid-state chemistry. This camera will be set up in the classroom (I don't know where exactly it will be placed yet). Then the researchers in charge of the project will review these lectures and then in the summer I will meet with them to discuss ways to improve my teaching of the course. And then I will repeat the process in Spring 2023 to gauge how effective the changes were at improving learning in my course.

I am anticipating that these recordings will start the week of March 14th or 21st. There will be a form I will pass out that will explain the video setup. If you do not wish to be recorded on the video then you are free to sit out of the camera's view. There will be some additional surveys for you to take to help the researchers assess my teaching. Of course, everything will be kept confidential and no names will be associated with anything that is passed along to the researchers.

Finally, I am in the process of figuring out whether or not I wish to use this data and publish a small paper based on the results. If I were to do this then I would need to get "human subjects" approval from our IRB (Institutional Review Board). Any time studies are done on humans, whether medical or non-medical, there are protocols that must be met in order to ensure that all subjects are protected. In order to submit to the IRB I will need to take 5 hours of training on human trials. There would be some additional paperwork from the school that would be required for you to fill out. I will let you know as soon as I can if this will happen and I believe that you will have the ability to opt out if you choose not to participate in my part of the study, but I will learn more as I make my way through the process.

I will say that the VIPER Fellows Project is somewhat unprecedented in terms of the ACS subdisciplines, only Inorganic has something like this. I am very excited to take part in this and I hope it will be beneficial to future Inorganic Chemistry students, and you will help lay the foundation!

