Intermediate Inorganic Chemistry **Chemistry 317**

Fall 2013 Prof. Jordan Fantini
M, W, F 10:30–11:20 a.m.; F 1:30 p.m. lab 208 Ebaugh
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Laboratory meets Fri. 1:30–4:20 p.m. in 214 Ebaugh
Text: *Inorganic Chemistry*, 5th ed. Miessler, Fischer & Tarr

Welcome to Inorganic Chemistry! I'm very glad that you're here. You may be wondering exactly what Inorganic Chemistry is, and there are surely a lot of ways to answer that question. On the simple side, we can say that inorganic is not organic chemistry, that is, it's concerned with all the elements that aren't carbon. But you won't be in inorganic chemistry very long before you notice that we deal with carbon too, just not in the way that organic chemists do. So, if it's not organic, and uses all the elements, that's a pretty broad field. Maybe inorganic chemistry should be described as a mindset. Professor Harry Gray of CalTech has called inorganic chemists "the marines of chemistry" for their willingness to tread fearlessly over all areas of the periodic table and apply diverse ideas of structure, bonding, and reactivity as warranted in different situations.

Inorganic chemistry is a broad field and, like organic chemistry, could easily fill two semesters and have plenty left over to learn. Since we have but one semester to explore the sub-discipline, we'll be selective, by necessity, about our coverage. Even in the areas we do cover, we'll treat them in different amounts of depth.

One can also bring different degrees of mathematical and chemical sophistication to the subject. We'll not assume a math background beyond first year calculus (we actually use little if any calculus) and not require any P-chem background at all. If you've been through second semester P-chem symmetry and group theory will be more familiar to you. Though we may go light on the math in places, we still seek sophistication in our models that help us to rationalize and understand chemical phenomena.

What kinds of goals do we have for the semester?

Our ***content goals*** span seven conceptual areas each of which is a chapter or more in our textbook. The units, which have different lengths, are listed below.

1. Intro/Atomic Structure/Simple Bonding Theory (Chapters 1–3)
2. Symmetry & Group Theory (Chapter 4)
3. Molecular Orbitals (Chapter 5)
4. Acid–Base & Donor–Acceptor Chemistry (Chapter 6)
5. The Crystalline Solid State, including X-ray crystallography (Chapter 7)
6. Main Group Chemistry & Oxidation–Reduction (Chapter 8)
7. Coordination Chemistry (Chapters 9–10; selected sections)

Our ***broader impact goals*** include:

1. learning and producing in the laboratory
2. laboratory report writing
3. making scientific oral presentations

How do we learn? (or) ***How should we spend 150 minutes a week together in class?***

Let's just say that if we're spending 150 minutes a week together, I'm assuming you're spending 450 minutes a week (or more) on the course without me (leaving lab out of the calculations).

What are out-of-class things to do?

book reading	There's a day-by-day schedule of readings. The book was chosen especially for this course, and I will tie my class lectures to the book as much as it is practical.
suggested problems	Working problems is how we learn chemistry. Especially for the early chapters, nearly all of the problems are appropriate. Working on the problems is a major way to learn and gain familiarity with the material. I'll suggest problems to work on, and provide solutions. These problems won't be collected or graded.
problem sets	Problem sets are due about every two weeks.
compose questions	Working on readings, homework problems, and problem sets is a great way to come up with questions about things you need a better understanding of. These questions provide the entry to a classroom experience that best matches your needs.

What should we be doing in class?

raise questions…	...and I'll develop answers that suit you and benefit the whole class.
actively follow worked examples and work on problems	Using the *Learning Catalytics* platform, we will work on in-class problems.
conventional lecture	To complement or enhance the textual coverage.

Grading (tentative weights shown):		**Grade determination (tentative ranges):**	
Three exams	30%	A:	90–100%
Final	15%	B:	80–89%
Problem Sets/Homework	10%	C:	65–79%
Paper	10%		
Presentation	10%	D:	55–64%
Laboratory	20%	F:	<55%
Participation(class/Piazza)	5%		
TOTAL	**100%**		

The grade cut-offs will not be raised under any circumstances. The addition of "+" and "–" to grades near the cut-offs will be made in some circumstances at the instructor's discretion.

Office hours are Tuesday 10:30 to 12:30. Please confirm all other appointments by email or schedule at the following web address:

meetwith.me/jordanfantini

Readings shown in the day-by-day calendar are from *Inorganic Chemistry*, 5th ed. Miessler, Fischer & Tarr.

Required Materials:

- *Inorganic Chemistry*, 5th ed. Miessler, Fischer & Tarr.
- Sapling Learning access code (you need to purchase)
- Learning Catalytics access code (complimentary)
- Lab Notebook of your choice, except not General Chem Style. Must have permanently attached pages.
- Access to a General Chemistry Text for treatment of the basics of structure and bonding.

Due dates and late work. Any assignments due on a day that class meets are due at the beginning of the class period. Late materials will be marked down 10% of the full point value of the assignment for each day late. This penalty will not be imposed on assignments turned in late on the same day they were due, or when the late submission is considered connected to an illness or similar circumstance. Assignments turned in late, especially after I have graded those of other students, may receive less feedback and be graded slightly differently (not intentionally harder, just different).

Exams. Exams will be in class on certain Mondays. The final exam will be comprehensive. It is inevitable that exams will come around the time that you have other important commitments, for this course and others. Realizing this, please plan ahead in the management of your time to prepare for these exams to your own personal satisfaction. Exam 1 on September 30 covers Chapters 2, 3, and 4; exam 2 on November 4 covers Chapters 5, 6, and 7(partial); exam 3 on December 9 covers Chapters 7, 8, and 9(partial). The final exam (December 20) is cumulative and includes the parts of chapters 9 and 10 that are covered in class. All of the exams focus on the chapters listed, but could have a necessary small connection to past material that fits in the context of the current material. A good example is that Unit 7 draws somewhat on Unit 3.

Quizzes. There won't be any quizzes. There are enough other things going on.

Laboratory. In preparation for any laboratory, I expect you to have gathered all supplemental information possible and read it before coming to the laboratory. You will need to prepare your notebook with a reagents and materials table along with an outline of planned procedure before lab starts. Our experiments may come from the primary literature (e.g. *Journal of Chemical Education)*. You will need to have access to a text that gives good detailed background on techniques to be used in the laboratory. Become familiar with this material before you come to lab in order to successfully perform the experiment.

Some experiments will require you to work briefly in the lab outside of the regularly scheduled period, at a time that is mutually convenient. Checking the status of a reaction reflux, checking a reaction to assure is hasn't dried up, or obtaining an overnight NMR spectrum are typical examples.

Laboratory Reports. Reports in the style of journal articles will be required for two experiments but most will have a shorter report format. High quality and detail is expected from beginning to end. We will be doing report rewrites for the long reports. Be sure to put your best foot forward when you hand in a report.

Laboratory notebook pages will be collected and graded for each experiment. *I cannot stress enough the importance of keeping a good notebook*. Remember—notebook pages, when properly kept, can be used as legal documents. And, more importantly, they are the final, most important proof of your chemical word.

Presentations. The details of the presentation guidelines will be given in a supplemental handout.

Participation. In such a small class, participation can—and should be—enjoyable and exciting. The last few times I taught this course, I tried different ways to foster active class participation. This year, one way I hope to have set things up well from the start is in the choice of textbook. The text by Miessler, Fischer & Tarr is one in which the authors aren't seeking to keep secrets from you. As I mentioned above, a lot of inorganic chemistry is unfamiliar, and I think these authors minimize the negative effect of the unfamiliarity by having an up-front approach to topics. Because of this, I consider this one of the most readable inorganic books I know. (Other good ones are Housecroft & Sharpe and Cotton, Wilkinson and Gaus.) So, since the book is readable, please do read it! Ahead of time. Come to class able to participate, able to answer reasonable questions I would pose, and able to ask reasonable questions of your own.

Use the class schedule above as a guide to the reading but realize that we could stray from those exact sections from time to time so be ready to read more or less from day to day. The assignments represent my best guess at what we'll cover and it's my expectation we'll keep on this schedule.

Homework. Homework is assigned as shown in the course schedule. You should work on it—working through problems is how we learn material. The Homework and Problem Sets count as part of your grade. I will make solutions available to the suggested book homework so that you may check your work on all the problems. In addition, you are encouraged to discuss the homework assignments with me and with your classmates both in and out of class (as class time allows). Problem Sets will be explained further at the appropriate time in class.

Academic Integrity Statement. Proposed and developed by Denison students, passed unanimously by DCGA and Denison's faculty, the Code of Academic Integrity requires that instructors notify the Associate Provost of cases of academic dishonesty, and it requires that cases be heard by the Academic Integrity Board. Further, the code makes students responsible for promoting a culture of integrity on campus and acting in instances in which integrity is violated.

Academic honesty, the cornerstone of teaching and learning, lays the foundation for lifelong integrity. Academic dishonesty is intellectual theft. It includes, but is not limited to, providing or receiving assistance in a manner not authorized by the instructor in the creation of work to be submitted for evaluation. This standard applies to all work ranging from daily homework assignments to major exams. Students must clearly cite any sources consulted—not only for quoted phrases but also for ideas and information that are not common knowledge. Neither ignorance nor carelessness is an acceptable defense in cases of plagiarism. It is the student's responsibility to follow the appropriate format for citations. Students should ask their instructors for assistance in determining what sorts of materials and assistance are appropriate for assignments and for guidance in citing such materials clearly.

As is indicated in Denison's Student Handbook , available through http://mydenison.edu, instructors must refer every act of academic dishonesty to the Associate Provost, and violations may result in failure in the course, suspension, or expulsion. (For further information, see http://www.denison.edu/about/ducai.pdf)

Integrity is a critical part of the scientific process; if your word cannot be believed, your academic reputation is destroyed for life. Please don't cheat—it is simply not worth it.

Harassment. Denison University "is committed to maintaining hospitable educational, residential, and working environments that permit students and employees to pursue their goals without substantial interference from harassment…regardless of race, sex, color, ethnic or national origin, religion, age, sexual orientation, disability, or Vietnam era veteran status." A more detailed description of University policy can be found in the student handbook concerning Antiharassment and Free Speech.

Disability Statement. Any student who feels he or she may need an accommodation based on the impact of a disability should contact me privately as soon as possible to discuss his or her specific needs. I rely on the Academic Support & Enrichment Center in 102 Doane to verify the need for reasonable accommodations based on documentation on file in that office.

Writing Center. The Center is a free resource available to all Denison students. Student writing consultants from many majors help writers one-on-one in all phases of the writing process, from deciphering the assignment, to discussing ideas, to developing an argument, to finalizing a draft. Check the website at http://www.denison.edu/writingctr/ for more information.

Suggested reference texts:

Shriver, Atkins
(helpful for symmetry, generally a high level of detail)

Bowser
(fairly descriptive, generally a moderate level of detail)

Cotton, Wilkinson & Gaus
(helpful for bonding & descriptive, generally a low level of detail)

Wulfsburg
(a different approach than most inorganic texts. replete with depth and detail)

Laboratory Safety:

Safety Check List

Working in an organic chemistry laboratory poses certain risks, which we have attempted to minimize. However, safety in the laboratory requires a strong commitment from all of us.

1. Safety goggles must be worn at all times. Do not wear contact lenses in the lab if possible.
2. Do not bring food or other nonessential lab equipment into lab.
3. Wear shoes that cover the top of your feet. Sandals must not be worn in the lab at any time and shorts are discouraged. Clothing is much easier to replace than skin! Still, don't wear expensive clothing or nylons. A laboratory coat may be a good investment. Wear long pants or skirts over knees. Avoid loose clothing, i.e. baggy shirtsleeves, jewelry, ties etc. Tie back long hair.
4. Never work alone in the laboratory. Someone must always be aware of what you are doing. Unauthorized experiments are not permitted.
5. Know the location and purpose of the safety devices in your lab.
    a. fire extinguishers
    b. safety shower
    c. eye wash/rinse hose
    d. fire blanket
    e. first aid kit
    f. liquid spill kit
    g. glass cleanup kit
    h. fume hood fan switch and operation status
    i. protective clothing (gloves, face shields, etc.)
6. Dispose of glassware and chemical wastes in the containers provided. Minimize the amounts of chemicals you use. Consult instructor for appropriate waste handling procedures.
7. Know the properties of the chemicals you are using.
8. Avoid the use of open flames.
9. Avoid contact with the materials you are handling. Inhalation and absorption through the skin or open cuts are common routes of entry. Gloves may be recommended for certain operations.

Laboratory Hygiene

It is important to leave the lab clean for the next group of students. Spills that you make around the balances and side shelves should be cleaned up immediately. Appropriately dispose of used pipets, weighing boats, etc. ***Before you leave the laboratory***, gather up your equipment, sponge off your work area, and ***put everything away***. Two students will be assigned each week to ensure the shared areas in the laboratory are clean.

Readings are FOR the day they are listed; stop at the point on the last page where a section (or sub-section) comes to an end. Homework is due 11:55pm on Thursdays.

Monday	Tues.	Wednesday	Thurs.	Friday	Friday lab
			Aug 29	**Aug 30** Ch 1: all sections	**check in & safety** cobalt(1)
Sept 2 Ch 2: 2.1 to 2.2.3	Sept 3	**Sept 4** Ch 2: 2.2.4	Sept 5	**Sept 6** Ch 2: 2.3	cobalt(2)
Sept 9 (JLF away) Ch 3: 3.1 to 3.2.2	Sept 10	**Sept 11** Ch 3: 3.2.3	Sept 12 HW2(ch2)	**Sept 13** Ch 3: 3.3 to 3.4	cobalt(3)
Sept 16 Ch 4: 4.1 to 4.2	Sept 17	**Sept 18** Ch 4: 4.3	Sept 19 HW3(ch3)	**Sept 20** Ch 4: 4.3	cobalt(4)
Sept 23 Ch 4: 4.4	Sept 24	**Sept 25** Ch 5: 5.1	Sept 26 HW4a(ch4a)	**Sept 27** Ch 5: 5.2	nickel(1)
Sept 30 **EXAM 1**	Oct 1	**Oct 2** Ch 5: 5.3 cobalt lab due	Oct 3 HW4b(ch4b)	**Oct 4** Ch 5: 5.4	nickel(2)
Oct 7 Ch 5: 5.4	Oct 8	**Oct 9** Ch 5: 5.4 cobalt lab returned	Oct 10 HW(ch5a)	**Oct 11** Ch 6: 6.1 to 6.3 nickel lab due (short)	(NO LAB) President's Inauguration
Oct 12 Ch 6: 6.4	Oct 13	**Oct 16** Ch 6: 6.4	Oct 17 HW(ch5b)	Oct 18	(NO LAB) Fall Break
Oct 21 Ch 6: 6.5 to 6.6	Oct 22	**Oct 23** Ch 7: 7.1 cobalt lab revisions due	Oct 24 HW(ch6a)	**Oct 25** Ch 7: 7.2 nickel lab returned	Lewis acid–base synthesis, calc, characterization
Oct 28 Ch 7: 7.3	Oct 29	**Oct 30** Ch 7: 7.4 to 7.5	Oct 31 HW(ch6b)	**Nov 1** Ch 7: 7.6 to 7.7	x-ray preparation
Nov 4 **EXAM 2**	Nov 5	**Nov 6** Ch 8: 8.1	Nov 7 HW(ch7)	**Nov 8** Ch 8: 8.2 to 8.4	x-ray trip
Nov 11 Ch 8: 8.5 to 8.6	Nov 12	**Nov 13** Ch 8: 8.7 to 8.8	Nov 14 HW(ch8a)	**Nov 15** **presentations**	**presentations**
Nov 18 Ch 8: 8.9 to 8.10	Nov 19	**Nov 20** Ch 9: 9.1 to 9.3	Nov 21 HW(ch8b)	**Nov 22** Ch 9: 9.4	make thermochromic cmpds & flash paper
Nov 25	Nov 26	Nov 27	Nov 28	Nov 29	(NO LAB)
Dec 2 Ch 9: 9.5	Dec 3	**Dec 4 course evals** Ch 10: 10.1	Dec 5 HW(ch9)	**Dec 6** Ch 10: 10.2 to 10.3	(NO LAB)
Dec 9 (JLF away) **EXAM 3**	Dec 10	**Dec 11** Ch 10: 10.3	Dec 12 HW(ch10)	**Dec 13** **review**	use thermochromic cmpds & flash paper
Dec 16	Dec 17	Dec 18	Dec 19	**Dec 20** **9a Final Exam**	

On-line aspects of the course:

Sapling learning.

Homework every week starting in the second full week.

To get started:

1. Go to http://saplinglearning.com and click "US Higher Ed" at the top right.
2. a. If you already have a Sapling Learning account, log in and skip to step 3.
   b. If you have Facebook account, you can use it to quickly create a SaplingLearning account. Click the blue button with the Facebook symbol on it (just to the left of the username field). The form will auto-fill with information from your Facebook account (you may need to log into Facebook in the popup window first). Choose a password and timezone, accept the site policy agreement, and click "Create my new account". You can then skip to step 3.
   c. Otherwise, click "create account". Supply the requested information and click "Create my new account". Check your email (and spam filter) for a message from Sapling Learning and click on the link provided in that email.
3. Find your course in the list (listed by subject, term, and instructor) and click the link.
4. Select your payment options and follow the remaining instructions.
5. Work on the Sapling Learning training materials. The activities, videos, and information pages will familiarize you with the Sapling Learning user environment and serve as tutorials for efficiently drawing molecules, stereochemistry, etc. within the Sapling Learning answer modules. These training materials are already accessible in your Sapling Learning course.

- Once you have registered and enrolled, you can log in at any time to complete or review your homework assignments.
- During sign up – and throughout the term – if you have any technical problems or grading issues, send an email to support@saplinglearning.com explaining the issue. The Sapling Learning support team is almost always faster and better able to resolve issues than your instructor.

Learning catalytics.

In-class activities. Each student has free access to the website this semester courtesy of Pearson Education.

Please sign up for a student account at www.learningcatalytics.com and use the code **XFQK7YN** for your registration.

Piazza.com.

A class “bulletin board” Q&A channel.

Sign up at: piazza.com/denison/fall2013/chem317

The class website.

Where you can find pdf copies of course materials (non-confidential). Also data from lab as needed.

(As of the start of class it is not ready. I will email you pdfs of things until the site is ready.)

Blackboard.

Where you can find pdf copies of solutions to homework from text (confidential). These materials should not be shared on the “public” web.