

San José State University
Department of Chemistry
Inorganic Chemistry, Chem 145, Fall, 2021

Course and Contact Information

Instructor:	Prof. Madalyn Radlauer (<i>she/her</i>)
Office Location:	DH 517
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Office Hours:	In person: Fri. 10:00 am – 11:00 am On Zoom: Wed. 3:30 pm – 4:30 pm Or by request (either in person or via Zoom)
Class Days/Time:	MWF 9:00 am – 9:50 am
Classroom:	MH 523
Prerequisite:	CHEM 112B (with grades of "C" or better; "C-" not accepted)
Co-requisite:	CHEM 113A

Note: Concepts and topics covered in General Chemistry (i.e. CHEM 1A & CHEM 1B) are essential for success in this class. We will review the relevant information, but we will do so rather quickly, so we will also have review sessions for anyone interested

Learning Assistant:	Christian Pham (<i>he/him</i>) christian.pham@sjsu.edu
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Course Website

Course materials such as the syllabus, handouts, notes, assignment instructions, etc. can be found on [Canvas](https://sjsu.instructure.com/) (https://sjsu.instructure.com/). Even though our class periods will be in person, videos, notes, and assignments will all be posted on Canvas, so you will likely be using it several times per week.

Course Description (from the [University Catalog](http://info.sjsu.edu/web-dbgen/splash/catalog.html): http://info.sjsu.edu/web-dbgen/splash/catalog.html)

Development of unifying principles to understand the chemistry of the elements. An introduction to the chemistry, bonding theories, and applications of coordination compounds.

Course Format

Partially Flipped Course

I wanted to use class time for discussion and problem solving in addition to more traditional lecture, so some of the lecture material has been made into edited videos that are available through the Canvas modules. As described in detail in the “Start Here” module on Canvas, the course will have a repeating pattern each week that includes lecture (both the videos and in person), discussions, group work, and short assignments. During class, you will work with me, our Learning Assistant, Christian Pham, and your classmates to engage with the material through lectures, discussions, group quizzes, and worksheets.

Course Goals and Learning Objectives

The goal of this course is to provide an introduction to inorganic chemistry, specifically regarding periodic trends, bonding theory, molecular symmetry, atomic and molecular orbitals, and coordination compounds.

Program Learning Outcome (PLO)

Upon successful completion of this program,

PLO 1.1: Students will be able to identify, formulate, and solve a range of chemistry problems (fundamental to complex) through application of mathematical, scientific, and chemical principles.

PLO 1.2: Students will be able to recognize, relate, and/or apply chemistry terms and concepts to propose and solve interdisciplinary and multidisciplinary real world problems.

PLO 3.1: Students will be able to explore, critique, and reflect on how chemistry relates to society, culture, and issues of equity and ethics that shape their scientific beliefs and identities.

PLO 3.2: Students will be able to identify as scientists within the scientific community through constructing peer reviews, engaging in collaborations, and participating in mentorship.

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

CLO 1: Predict and classify the structures of various inorganic complexes.

CLO 2: Predict the properties of various inorganic complexes and use this prediction to distinguish between molecules.

CLO 3: Discuss and employ atomic structure and bonding models, including molecular orbitals, to interpret experimental and spectroscopic evidence.

CLO 4: Apply concepts and models of symmetry, structure, and bonding to other areas in chemistry such as organic and biochemistry, and to use these concepts to more deeply examine many aspects of biology, forensic science, materials science, and environmental science.

Texts/Readings

Textbook (recommended, available via the SJSU campus bookstore and on reserve at the MLK Library)

[*Inorganic Chemistry*](#) by Gary L. Miessler, Paul J. Fischer, and Donald A. Tarr (5th edition, 2014) ISBN: 9780321811059.

Because this text is expensive, I am in the process of transitioning to a free textbook option. The site is still under construction so it's not a complete text, but you can find some useful readings at the following website: [https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Map%3A_Inorganic_Chemistry_\(Miessler_Fischer_Tarr\)](https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Map%3A_Inorganic_Chemistry_(Miessler_Fischer_Tarr)).

Other References (not required, on reserve at the MLK Library)

[*Inorganic Chemistry*](#) by Catherine E. Housecroft and Alan G. Sharpe

[*Chemical Applications of Group Theory*](#) by F. Albert Cotton

[*Symmetry and Spectroscopy*](#) by Daniel C. Harris and Michael D. Bertolucci

Model Kit (highly recommended)

A model kit can be a great help in this course, especially early on. Look for one with atoms that can bind to 1-6 other atoms or groups.

Library Liaison

You should have a student library account with the King Library that allows you access the library electronic databases. If you plan to access the library services from off-campus, you may need to obtain a password and/or proxy to do so. Check the Library website for information. The reference Librarian for Chemistry is Yen Tran and her email is yen.tran@sjsu.edu.

Course Requirements and Assignments

Graded work will include in-class group quizzes, in-class worksheets, take-home problems, pre-class questions, Canvas discussion posts, three midterm exams, and one comprehensive final exam, which all contribute to the course learning outcomes. Dates for the exams are in the Course Schedule below. All relevant dates are also posted to Canvas. Exams and assignments in the course will be weighted as follows:

Assignments	Points
Group Quizzes	100
Worksheets	75
Take-home Problems	250
Canvas Discussions	100
Pre-class Questions	50
Midterm Exams (85 points each)	255
Final Exam	170
Total	1000

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.

Weekly Workflow

Weekday	Activities
before Monday	Watch the video and post to the Canvas Discussion
Monday	Lecture/discussion, then start Group Quiz (last 15 minutes); submit Take-Home Problem (from last week) by midnight
before Wednesday	Look through the recommended reading (also a good time to try a few of the recommended problems), continue back-and-forth on Group Quiz
Wednesday	In-class Worksheets in groups and as a whole class; submit Worksheet scan, Pre-class Questions, and respond to a Discussion post by midnight
before Friday	Finalize Group Quiz responses
Friday	Lecture/discussion to take the material to the next level

Final Examination or Evaluation

The Final Exam is comprehensive and will have a range of question styles that will be similar to the other assignments and exams in the course.

Grading Information

Determination of Grades

Points will be distributed as described in Course Requirements and Assignments above. I will not curve because I believe that everyone can succeed in this course. I may, at the end of the course, linearly shift the scale. I will only shift it to benefit you. The course grade will be determined from the resulting average of the point total as follows:

<u>Percentage of Total Points</u>	<u>Final Course Grade</u>
96 and above	A+
92 to 95.9	A
88 to 91.9	A-
84 to 87.9	B+
80 to 83.9	B
76 to 79.9	B-
72 to 75.9	C+
68 to 71.9	C
64 to 67.9	C-
60 to 63.9	D+
56 to 59.9	D
52 to 55.9	D-
less than 52	F

Course Modules

The course is organized into four modules on Canvas, each covering several weeks of material. These modules will lay out the lecture videos and recommended reading, the worksheets, and the assessments for each major course topic. The three midterm exams will cover large sections of the course and though they will mostly be associated with one module, later modules will rely on the information learning earlier in the course. The final exam is cumulative.

Group Quizzes

Each Monday during the last ~15 minutes of class, you will do a Group Quiz, but this content will not be graded until Friday. These quizzes will be brief and generally cover things from the pre-class video and that day's in-class lecture (though material from the previous week(s) may also be relevant). The format will typically include 1 or 2 multiple choice questions with space to explain your answers. The questions are intended to get you to think about the new material and try to apply it to a question or two. For this assignment, your group will discuss the question(s) and put down your initial ideas and then we will have a bit of back and forth via Canvas before you submit your "final" answer for grading.

In-class Worksheets

Worksheets will be posted to the module before class each Wednesday. You will need to access the worksheet for class. It will be formatted so that you can do your work directly on the worksheet. I will have printed copies for everyone in class (though if you prefer to work on a tablet or similar, let me know and I won't print it). These worksheets will be graded for participation. This will be measured in two ways. First, the LA and I will come around to groups to check in and offer assistance. I expect you to use this time to engage with the material and work together. Second, you will take a photo and upload your work to Canvas right after class. You do not need to complete the worksheet to get credit, but I recommend that you complete all of the worksheets as these are intended to help you learn the material.

Canvas Discussions

The Canvas Discussions will have two parts each week. The first will be due by Sunday at midnight and the second will be due by Wednesday at midnight. In addition to a topic specific question (or two), every week's discussion will ask for the "muddiest point" from that week, i.e. the part of the topic being covered that is least clear to you. There will also be a question that requires you to respond to a post or posts from your classmates.

Pre-class Questions

The Pre-class Questions will be posted to the appropriate module along with the lecture video each Friday after class and will be due by midnight on Wednesday. These will typically be multiple choice and will rely on the material covered in Monday's and Wednesday's class periods. They might also be right out of the week's recommended reading. ;)

Take-home Problems

Instead of having large problem sets due a few times throughout the semester, we are using a model where there will be one or two questions to work through each week. They will be posted at the same time as the in-class worksheets (by Wednesday at the latest) and will be due by midnight on Monday. Typically, you will both have to provide solutions as well as explain how you went about getting them and why your solution makes sense to you. The Take-home Problems are intended to challenge you, so don't be surprised if they're tough. My goal is that these questions be more difficult than anything you see on the midterms so that if you have a good understanding of them, you'll rock the exams. You are welcome to bring questions about the Take-home problems to me (or our LA) at office hours, etc. or to work on them in groups as long as everyone does their own work. I will try to get you feedback within a week and I will post the key right away so that you can use them to study.

Extra Practice Problems

In addition to the graded Take-home Problems, I will post recommended problems from the textbook. These will not be graded, but I have often gotten requests for more practice problems, so here they are! Feel free to pick and choose which exercises you attempt, I list all of the problems that I think are interesting/well-suited to how I teach the course, so they might start to feel repetitive. Solutions to exercises are at the back of the textbook (Appendix A) and solutions to the problems have been posted to Canvas. While all the solutions are provided to you up front, remember that you will learn more effectively by attempting the problems before looking at the answers.

Recommended Reading

In each module, I will post recommended reading from the book. While this is not required, it offers you another way to learn the material.

Missed Exams or Assignments

The difficult circumstances of the past year and a half have not gone away and I am aware that the havoc in our world has forced us to work and learn under various stressors. This may make it more difficult for you to maintain a steady schedule and you may need to miss class or an assignment at some point in the semester. If this is the case, please contact me ahead of class time and with as much of a heads up as possible and we can discuss the situation. The more heads up you can give me, especially with regards to missing exams or assignment deadlines, the better. I will do my best to be accommodating.

Classroom Protocols

As a show of respect to your fellow classmates and me, please be on time to class; we will start at 9:00 am sharp. Please do not come to class if you do not feel well. Email me and the LA, Christian Pham, and we can set up one of two options for you.

1. If you would like to attend class virtually, we can set up a Zoom meeting *as long as you email the LA and myself at least 10 minutes before class starts.*
2. We can get notes sent to you and arrange for you to make up any group work.

I hope that the classroom will serve as an environment that will promote learning and the development of new ideas, as well as be a safe and respectful community. If anything in the classroom makes you feel uncomfortable or disrespected, especially if it is something that I say or do, please bring it to my attention. You all are students, but you are people first and foremost, and the classroom should be a place you feel welcomed and respected.

Email policy

I receive a lot of emails, so to be sure that I see your email, all Chem 145 emails should have Chem 145 in the subject line. I will do my best to respond to class-related emails within 1 business day of receiving them, however, keep in mind that this may not always be possible. You can also message me via Canvas and I will target a similar turnaround time.

COVID-19 Related Policies

Masks are **REQUIRED** in the classroom and they must cover both your nose and mouth. I have a toddler who cannot be vaccinated, so even if SJSU lifts its mask mandate, I will continue to require masks in the classroom for the entire semester. Anyone not wearing a mask will not be allowed to attend class.

For the time being, SJSU is not requiring social distancing, so that we can do group work in person. If this changes, we may have to go at least partly online in order to do group assignments without having to yell across the room.

All students coming to campus for College of Science classes must go through the College of Science COVID training. This primarily includes watching a video prepared by the Safety Team and reading the SJSU Adapt Plan.

Everyone at SJSU is required to be fully vaccinated against COVID-19 by September 30, 2021.

If you have COVID symptoms, a positive COVID test, or are exposed to someone who tests positive for COVID, **DO NOT COME TO CAMPUS**. Email me and I will send you a follow up email with the appropriate protocols to follow.

University Policies

Per [University Policy S16-9](#), relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on [Syllabus Information web page](#) (<https://www.sjsu.edu/curriculum/courses/syllabus-info.php>). Make sure to visit this page to review and be aware of these university policies and resources.

Inorganic Chemistry, Chem 145, Fall 2021, Course Schedule

The tentative course calendar below includes weekly course content, exam dates, and the date for the final exam. Dates may be subject to change, but prior to this, fair notice will be given during class and through Canvas. The recommended reading and problems from our primary textbook, *Inorganic Chemistry* by Miessler, Fischer, and Tarr will be listed on the Canvas site along with each module. The related modules are indicated in bold as M0, M1, M2, M3, and M4.

Tentative Course Schedule

Class	Week	Date	Topics, Readings, Assignments, Deadlines
1	1	F 8/20	<i>First day of classes</i> Introduction to course
2	2	M 8/23	M1: Drawing structures and finding symmetry elements
3	2	W 8/25	M1: Symmetry elements worksheet
4	2	F 8/27	M1: Symmetry elements and point groups
5	3	M 8/30	M1: Point groups
6	3	W 9/1	M1: Point groups worksheet
7	3	F 9/3	M1: Character tables
	4	M 9/6	<i>Labor Day – No class</i>
8	4	W 9/8	M1: Character tables worksheet
9	4	F 9/10	M1: How to use character tables
10	5	M 9/13	M1: How to use character tables
11	5	W 9/15	M1: Reducing reducible representations worksheet
12	5	F 9/17	M1: Applications in vibrational spectroscopy
13	6	M 9/20	M1: Applications in vibrational spectroscopy
14	6	W 9/22	M1: Review
15	6	F 9/24	Midterm Exam 1 (covering Module 1)
16	7	M 9/27	M2: Diatomic MO diagrams
17	7	W 9/29	M2: Diatomic MO diagrams worksheet
18	7	F 10/1	M2: Moving to larger molecules
19	8	M 10/4	M2: SALCs
20	8	W 10/6	M2: SALC The Game
21	8	F 10/8	M2: MO diagrams of more complex molecules
22	9	M 10/11	M2: MO diagrams of more complex molecules
23	9	W 10/13	M2: Review

Class	Week	Date	Topics, Readings, Assignments, Deadlines
24	9	F 10/15	Midterm Exam 2 (covering Module 2)
25	10	M 10/18	M3: Electron counting and ligand types
26	10	W 10/20	M3: Recognizing ligand types worksheet
27	10	F 10/22	M3: Electronic properties of ligands
28	11	M 10/25	M3: MOs of octahedral complexes and delta octahedral
29	11	W 10/27	M3: MOs of octahedral complexes worksheet
30	11	F 10/29	M3: Delta octahedral trends
31	12	M 11/1	M3: MOs of complexes with other symmetries
32	12	W 11/3	M3: d-d splitting worksheet
33	12	F 11/5	M3: Spectrochemical series and high and low spin complexes and distortions of the ligand field
34	13	M 11/8	M3: Starting from scratch on an MO diagram of a transition metal complex
35	13	W 11/10	M3: Review
36	13	F 11/12	Midterm Exam 3 (covering Module 3)
37	14	M 11/15	M4: Magnetism, Electronic spectroscopy
38	14	W 11/17	M4: Electronic spectroscopy worksheet
39	14	F 11/19	M4: Types of charge transfer
40	15	M 11/22	M4: Reactivity
	15	W 11/24	<i>Thanksgiving Break – No class</i>
	15	F 11/26	<i>Thanksgiving Break – No class</i>
41	16	M 11/29	M4: Intro to organometallic and bioinorganic chemistry
42	16	W 12/1	M4: Applications worksheet
43	16	F 12/3	M4: Review
44	17	M 12/6	<i>Last day of classes</i> Class wrap-up
	Final Exam	Th 12/9	<i>Assigned final exam time is 7:15 – 9:30 am</i>
		F 12/17	<i>Grades available</i>