

**San José State University**  
**Department of Chemistry**  
**Inorganic Chemistry, Chem 145, Fall, 2019**

<b>Instructor:</b>	Prof. Madalyn Radlauer
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<b>Office Hours specifically for Chem 145:</b>	Mon. 3:00 pm – 4:00 pm Fri. 10:00 am – 11:00 am
<b>Additional office hours:</b>	Tues. 3:00 pm – 4:00 pm Fri. 11:00 am – 12:00 pm or by appointment
<b>Class Days/Time:</b>	MWF 9:00 am – 9:50 am
<b>Classroom:</b>	DH 415
<b>Prerequisite:</b>	CHEM 112B (with grades of "C" or better; "C-" not accepted)
<b>Co-requisite:</b>	CHEM 113A

*Note: Extensive knowledge and thorough understanding of concepts and topics covered in General Chemistry (i.e. CHEM 1A & CHEM 1B) are essential for success in this class. To that end, CoSAC will host general chemistry review sessions for CHEM 145 students in the second week of classes.*

### 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/>). You are responsible for regularly checking with the messaging system in Canvas to learn of any updates. Pre-class questions will be posted to Canvas by 8 am the day before class (unless there is an exam or problem set in that class period). These will count toward your grade and must be completed at least 30 minutes before class begins (see below for details). Problem sets will be posted to Canvas 2 weeks before they are due.

**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 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, students will be able to:

PLO 1: Demonstrate understanding of core concepts and to effectively solve problems in inorganic chemistry.

### 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** (required for course readings)

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

*This textbook is available in the SJSU campus bookstore. An electronic copy of this textbook is available to borrow through the King Library. Prof. Radlauer also has a hard copy of the book that can be checked out during office hours and borrowed until the next class period.*

**Other References** (not required, these may provide further clarification of various topics)

[\*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

*These texts are on reserve at the King Library. They can also be checked out from Prof. Radlauer during office hours and borrowed until the next class period.*

### 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](mailto:yen.tran@sjsu.edu).

## Course Requirements and Assignments

Graded work will include online pre-class questions, eleven in-class group quizzes, eleven in-class group activities, three problem sets, three in-class exams, and one comprehensive final exam, which all contribute to the course learning outcomes. Dates for the exams and due dates for the problem sets are in the Course Schedule below. All relevant dates are also posted to Canvas. In addition to the graded material, practice problems from the text will be suggested, but not graded. Reading the text and working recommended problems are an excellent way to prepare for classes and exams. Exams and assignments in the course will be weighted as follows:

<b>Assignments</b>	<b>Points</b>
Online Pre-class Questions (details below)	100
In-class Group Quizzes (8 points each, lowest score gets dropped)	80
In-class Group Activities (8 points each, lowest score gets dropped)	80
Problem Sets (55 points each)	165
Midterm Exams (125 points each)	375
Final Exam	200
<b>Total</b>	<b>1000</b>

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.

## Final Examination or Evaluation

The Final Exam is comprehensive and will be written in a style similar to the Midterm Exams including primarily short answer questions.

## Grading Information

### Determination of Grades

Points will be distributed as described in Course Requirements and Assignments above. I will not curve, though 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

## Online Pre-Class Questions

Before every class (except when problem sets are due and when there are exams), I will post a question related to the material. They will be posted on Canvas by 8 am the day before class and they need to be completed by 30 minutes before class begins. These questions will be graded 80% for completion and 20% for accuracy. You are encouraged to use your notes to help you answer these questions, but please work on them by yourself. The objective of these brief assignments is for me to get a sense of how well you understand the material. If there are any technical issues with Canvas, email me at the time of the issue.

<u>Questions Answered (%)</u>	<u>Score</u>
90 to 100	100
80 to 89	85
70 to 79	70
60 to 69	50
50 to 59	25
less than 50	0

## In-class Group Quizzes and Activities

During the first class period you will choose one playing card out of a deck. Groups will be assigned by shuffling all students' cards together and laying them out in groups of 3 or 4 for each group quiz and group activity.

On the Fridays when we do not have exams, the first 10 minutes of class will be devoted to a group quiz. With your randomly-assigned group, you will solve 2 multiple choice questions and explain your answers. These quizzes will be graded for accuracy and more weight will be given to your explanation than to your answer. The quizzes will primarily cover material that we discussed in class on Monday/Wednesday of that week and may also involve earlier material. I will post a key for each quiz on Canvas. There will be 11 quizzes in total and I will drop your lowest grade.

The remainder of those Friday class periods will be used for a variety of in-class group activities with, generally in the form of worksheets, which you will work on with your randomly-assigned group. These will be graded based on participation, so any portion of class that you miss will lower your score. Many of the worksheets are long, but they are intended to provide you with ample practice and examples prior to seeing these types of questions on Problem Sets or Exams. I will post a follow-up to each activity on Canvas. There will be 11 activities in total and I will drop your lowest grade.

## Problem Sets

Problem sets will be due by the beginning of class on their due date, but they will be accepted at the end of the class period as well. Late assignments will not be accepted. Problem sets can be done in groups, but each student must turn in their own individual work. Working in groups does not mean copying down each other's answers. Please do your own work.

## Recommended Problems

In addition to the three problem sets, carefully study the book and lecture notes and ask questions on any material you do not understand. I have 2 scheduled office hours specifically for Chem 145 students, 2 additional office hours (which are intended to be for Chem 55 students), and I am willing to schedule office hours by appointment if none of these times accommodate your schedule.

Recommended problems from the textbook are assigned to correspond with the lecture material. Additionally, the recommended problems will be representative of the type of questions you will see on the exams. They will not be collected or graded. 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.

### **Missed Exams and Group Activities**

If an exam, group quiz, or group activity is missed without a legitimate excuse, a score of 0 will be entered for that assignment. If an acceptable excuse is provided, then the grade will be the average of your other grades in that assignment category. In no case will a make-up exam, in-class quiz, or in-class activity be given. Contact me *in advance* if you will miss a group quiz, group activity, or exam date for a legitimate activity. There will be no final exam rescheduling unless you have 3 exams on the same date.

### **Exam Regrades**

To qualify for an exam regrade, you must take the exam in ink and not use white-out. Do not write on your exams that are submitted for a regrade. Submitting a modified exam for regrading is a serious breach of academic integrity. Regrades must be submitted within one week of the exam being handed back to you. Regrade requests must include a written description of what you feel was graded incorrectly. One exception to all of the above: if I made an arithmetic error in your point tally, simply write “tally error” and I will check the point tally.

### **Classroom Protocol**

Be on time to class; class starts at 9:00 am sharp. Device use in class should be limited to taking notes. No device use is allowed during exams. Students are strongly encouraged to participate during the class period.

### **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, especially during high volume times (around exams).

### **University Policies**

Per [University Policy S16-9](http://www.sjsu.edu/senate/docs/S16-9.pdf) (<http://www.sjsu.edu/senate/docs/S16-9.pdf>), relevant information to all courses, such as academic integrity, accommodations, dropping and adding, consent for recording of class, etc. is available on Office of Graduate and Undergraduate Programs' [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/>.

### **Safe and Respectful Community**

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. Behavior that interferes with the normal academic function in a classroom is unacceptable. Students exhibiting this behavior will be asked to leave the class. The university has a [brochure on student conduct](http://www.sjsu.edu/studentconduct/docs/ENGLISH%20Brochure.pdf) at <http://www.sjsu.edu/studentconduct/docs/ENGLISH%20Brochure.pdf>.

Examples of such behavior include

1. Persistent interruptions or using disrespectful adjectives in response to the comments of others.
2. The use of obscene or profane language.
3. Yelling at classmates and/or faculty.
4. Persistent and disruptive late arrival to or early departure from class without permission.
5. Physical threats, harassing/bullying behavior, or personal insults (even when stated in a joking manner).
6. Use of personal electronic devices such as pagers, cell phones, PDAs in class, unless it is part of the instructional activity.

## Inorganic Chemistry, Chem 145, Fall 2019, Course Schedule

The tentative course calendar below includes weekly course content, problem set due dates, 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. Reading and problems listed in the schedule are referencing the primary textbook: *Inorganic Chemistry* by Miessler, Fischer, and Tarr.

### Tentative Course Schedule

Class	Week	Date	Topics, Readings, Assignments, Deadlines
1	1	W 8/21	<b>First day of classes</b> In-class survey, introduction to course (Chapter 1)
2	1	F 8/23	Electrons, orbitals, and periodic trends (Chapter 2)
3	2	M 8/26	Lewis structures and VSEPR (Chapter 3)
4	2	W 8/28	Symmetry elements (4.1)
5	2	F 8/30	Symmetry elements and point groups (4.2) <b>GQA-I</b>
	3	M 9/2	<b>Labor Day – No class</b>
6	3	W 9/4	Point groups, cont. (4.2)
7	3	F 9/6	Matrices and irreducible representations (4.3) <b>GQA-II</b>
8	4	M 9/9	Mulliken symbols and character tables (4.3)
9	4	W 9/11	Character tables, cont. (4.3)
10	4	F 9/13	<b>Problem Set 1 Due</b> Using character tables (4.3) <b>GQA-III</b>
11	5	M 9/16	Transforming atomic orbitals with symmetry operations (4.4)
12	5	W 9/18	Reducing reducible representations (4.4)
13	5	F 9/20	<b>Exam 1 (coverage Chapters 1-4.3)</b>
14	6	M 9/23	Vibrational spectroscopy (4.4)
15	6	W 9/25	Vibrational spectroscopy + intro to MOs (4.4, 5.1)
16	6	F 9/27	MO theory and homodiatom molecules (5.1-5.2) <b>GQA-IV</b>
17	7	M 9/30	MO diagrams for heterodiatom molecules (5.3)
18	7	W 10/2	Orbital mixing and SALCs by inspection (5.2-5.4)
19	7	F 10/4	SALCs from group theory (5.4) <b>GQA-V</b>
20	8	M 10/7	Using the projection operator (5.4)
21	8	W 10/9	SALCs and the projection operator (5.4)
22	8	F 10/11	<b>Problem Set 2 Due</b> Making MO diagrams of more complicated molecules (5.4) <b>GQA-VI</b>
23	9	M 10/14	Coordination chemistry – types of ligands (13.1-13.2)

Class	Week	Date	Topics, Readings, Assignments, Deadlines
24	9	W 10/16	Electron counting – d-counts, valence counts (13.3, 13.7)
25	9	F 10/18	<b>Exam 2 (coverage Chapters 4-5)</b>
26	10	M 10/21	Octahedral complexes and ligand field theory (10.1-10.4)
27	10	W 10/23	Octahedral complexes and ligand field theory (10.1-10.4)
28	10	F 10/25	Square planar complexes (10.1-10.4) <b>GQA-VII</b>
29	11	M 10/28	Tetrahedral complexes (10.1-10.4)
30	11	W 10/30	Spectrochemical series, high and low spin (10.4-10.7)
31	11	F 11/1	Magnetic moments, Jahn Teller distortions (10.4-10.7) <b>GQA-VIII</b>
32	12	M 11/4	Electronic Spectra (Chapter 11)
33	12	W 11/6	Tanabe-Sugano diagrams, selection rules, and calculating d-d splitting (Chapter 11)
34	12	F 11/8	<b>Problem Set 3 Due</b> Charge Transfer: MLCTs, LMCTs, MMCTs (Chapter 11) <b>GQA-IX</b>
	13	M 11/11	<i>Veteran's Day – No class</i>
35	13	W 11/13	Review
36	13	F 11/15	<b>Exam 3 (coverage Chapters 10-11)</b>
37	14	M 11/18	Reactions and Mechanisms (Chapter 12)
38	14	W 11/20	Reactions and Mechanisms (Chapter 12)
39	14	F 11/22	Reactions and Mechanisms (Chapter 12) <b>GQA-X</b>
40	15	M 11/25	Organometallic Chemistry (Chapters 13 and 14)
	15	W 11/27	<i>Thanksgiving Break – No class</i>
	15	F 11/29	<i>Thanksgiving Break – No class</i>
41	16	M 12/2	Organometallic Chemistry (Chapters 13 and 14)
42	16	W 12/4	Special topics: Class choice #1
43	16	F 12/6	Review, Part I <b>GQA-XI</b>
44	17	M 12/9	<i>Last day of classes</i> Review, Part II and class wrap up
	<b>Final Exam</b>	F 12/13	<b>Coverage is cumulative</b> 7:15 am – 9:30 am in DH 415 (usual classroom)
		F 12/20	<i>Grades available</i>