

Chem231: Advanced Inorganic Chemistry, 3.0 credits

Fall 2020 Lecture

MWF, Asynchronous lectures posted to Blackboard at 1:00 pm

Instructor

Prof. Matt Liptak

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Discussion / Office Hours

MWF, 12:00 – 12:50, Remote via Teams

Technical support for students

Students, please read this technology check list to make sure you are ready for classes.

<https://www.uvm.edu/it/kb/student-technology-resources/>

Students should contact the Helpline (802-656-2604) for support with technical issues

Prerequisites

Chem047, Chem141, or Chem143 (one semester of organic chemistry)

AND Chem165 (one semester of physical chemistry)

General Education Requirements

This course does *not* satisfy any general education requirements

Chem231 does partially satisfy the *College of Arts and Sciences Natural Sciences* distribution requirement.

Chem231 is a requirement for the **Chemistry majors**.

Chem231 is an acceptable *advanced elective* for the **Biochemistry major**.

Chem231 is *not* an acceptable *elective* for the **Chemistry minor**.

Course Description

Chem 231 will cover the fundamentals of inorganic chemistry within the frameworks of molecular symmetry and molecular orbital theory. All areas of inorganic structure, bonding, and reactivity will be covered, with an emphasis on transition metal complexes. This course is lecture-based, there is no associated laboratory.

Course Learning Objectives

Upon completion of Chem 231, it is anticipated that you will:

1. Understand the relationship between molecular symmetry and bonding.
2. Appreciate the use of molecular orbital theory as a *general* approach that can explain the chemical properties of inorganic and organic molecules.
3. Recognize why transition metal complexes can have structures and properties unique from those of main group compounds.

Modality Description

Discussion / Office Hours will be used for discussion of asynchronous lectures posted to Blackboard and solving practice problems. You should watch the asynchronous lectures *prior* to the scheduled discussion so you are prepared to ask questions and work through practice problems.

You are *strongly* encouraged to ask any course-related questions during our Teams discussion. Based upon past experience, I can almost guarantee someone else in the course has the same question! However, if you have a question of a private nature you should contact me via e-mail: matthew.liptak@uvm.edu

Textbook

Miessler, G.L. and Tarr, D.A. *Inorganic Chemistry*, 5th Ed., Prentice Hall, 2013
The 3rd and 4th edition of this textbook are acceptable alternatives.

Web Content

Lectures, Lecture notes, quizzes, quiz answer keys, and exams will be available through Blackboard (bb.uvm.edu). These materials are available for all current, UVM-affiliated, students, but they may not be shared off-campus without permission of the instructor.

Discussion / Office Hours will be carried out using Microsoft Teams.

Attendance Policy

I do not take attendance in Chem231, but you are expected to attend all Discussion sections. The practice problems are designed to help you master the course material and the answer to another student's question may help you with a difficult topic. If you miss Discussion for any reason, it is **your** responsibility to catch-up on missed material by reviewing practice problems posted to Blackboard.

Grading

Your grade will be based upon quizzes (25% total) and three exams (25% each). I strive to be as accurate as possible when grading quizzes and exams, but will occasionally make a mistake. You may request a complete regrade of an assignment, plus a clear explanation for any lost points, at any point prior to administration of the final exam. I will retain your graded final exams for one year after completion of the course.

Quizzes

A total of 12 open-book, open-notes quizzes will be administered via Blackboard throughout the semester. Quizzes will be due at 11:59 pm on the date noted below, and the answers will be available on Blackboard at 12:01 am the next day (2 minutes later). Thus, **no extensions will be granted** for the quizzes, but your lowest two grades out of the 12 quizzes will be dropped to accommodate excused and unexcused absences.

Exams

Three exams are scheduled for Chem 231, which will cover units 1 – 3 separately. In other words, the exams will not be cumulative. Exams will be administered via Blackboard on: **October 2** (Exam #1), **November 2** (Exam #2), and **TBA** (Exam #3). You will be able to take these exams during any three hour window on these dates. There will be no Discussion on exam days.

Course Evaluations

All students are expected to complete course evaluations in-class on **December 4**. The evaluations will be anonymous and confidential. The information gained from these evaluations will be used to iteratively improve Chem231 for future *UVM* students.

General statement regarding potential changes during the semester:

<http://catalogue.uvm.edu/>

The University of Vermont reserves the right to make changes in the course offerings, mode of delivery, degree requirements, charges, regulations, and procedures contained herein as educational, financial, and health, safety, and welfare considerations require, or as necessary to be compliant with governmental, accreditation, or public health directives.

Green and Gold Promise:

The [Green and Gold Promise](#) clearly articulates the expectations that UVM has for students, faculty, and staff to remain compliant with all COVID-19 recommendations from the federal CDC, the State of Vermont, and the City of Burlington.

The [Code of Student Conduct](#) outlines policies related to violations of the Green and Gold Promise. Sanctions for violations include fines, educational sanctions, parent notification, probation, and suspension.

Intellectual Property Statement/Prohibition on Sharing Academic Materials:

Students are prohibited from publicly sharing or selling academic materials that they did not author (for example: class syllabus, outlines or class presentations authored by the professor, practice questions, text from the textbook or other copyrighted class materials, etc.); and students are prohibited from sharing assessments (for example homework or a take-home examination). Violations will be handled under UVM's Intellectual Property policy and Code of Academic Integrity.

Statement on Diversity and Inclusion

I strive to create a classroom environment that supports students from a diverse set of backgrounds. Our society is composed of individual from diverse ethnic, socioeconomic, and educational backgrounds. Half of our society are women. I strongly believe that our best path forward to a stronger and more equitable society is to promote inclusiveness.

It is my expectation that every member of this class will also support diversity and inclusion. As a community, we should strive to uphold the ideals of Our Common Ground:

<https://www.uvm.edu/president/our-common-ground>

I welcome any suggestions as to how I can promote a diverse and inclusive classroom.

The instructor reserves the right to change everything, with notice

Tips for Success

Chem231 is a 3.0 credit course. As such, you are expected to spend 3 hours per week watching asynchronous lectures, 3 hours per week attending remote discussions, and devote 3-6 additional hours per week to Chem231. This breaks down to 1-2 hours per lecture.

I strongly recommend devoting one of these hours to reading the textbook section noted in the syllabus, and working through any examples or exercises in that section. I recommend that you devote another hour to working on assigned quizzes. There will be 3-4 questions clearly associated with each lecture. Quizzes are distributed in three lecture increments and due approximately once a week to give you scheduling flexibility. But, I think the most effective strategy is devote an hour after each lecture to quizzes instead of waiting to devote three hours just before the due date.

E-mail

I will respond to all e-mails within one working day. Unfortunately, due to my numerous commitments at UVM, I typically do not have the ability to respond immediately.

University-wide Policies and Procedures**Student Learning Accommodations**

In keeping with University policy, any student with a documented disability interested in utilizing accommodations should contact SAS, the office of Disability Services on campus. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. All students are strongly encouraged to meet with their faculty to discuss the accommodations they plan to use in each course. A student's accommodation letter lists those accommodations that will not be implemented until the student meets with their faculty to create a plan.

Contact SAS:

A170 Living/Learning Center;
802-656-7753;
access@uvm.edu
www.uvm.edu/access

Religious Holidays

Students have the right to practice the religion of their choice. If you need to miss class to observe a religious holiday, please submit the dates of your absence to me in writing by the end of the second full week of classes. You will be permitted to make up work within a mutually agreed-upon time. <https://www.uvm.edu/registrar/religious-holidays>

Academic Integrity

The policy addresses plagiarism, fabrication, collusion, and cheating.
<https://www.uvm.edu/policies/student/acadintegrity.pdf>

Grade Appeals

If you would like to contest a grade, please follow the procedures outlined in this policy:

<https://www.uvm.edu/policies/student/gradeappeals.pdf>

Grading

For information on grading and GPA calculation, go to <https://www.uvm.edu/registrar/grades>

Code of Student Conduct

<http://www.uvm.edu/policies/student/studentcode.pdf>

FERPA Rights Disclosure

The purpose of this policy is to communicate the rights of students regarding access to, and privacy of their student educational records as provided for in the Family Educational Rights and Privacy Act (FERPA) of 1974.

<http://catalogue.uvm.edu/undergraduate/academicinfo/ferparightsdisclosure/>

Promoting Health & Safety

The University of Vermont's number one priority is to support a healthy and safe community:

Center for Health and Wellbeing

<https://www.uvm.edu/health>

Counseling & Psychiatry Services (CAPS)

Phone: (802) 656-3340

C.A.R.E.

If you are concerned about a UVM community member or are concerned about a specific event, we encourage you to contact the Dean of Students Office (802-656-3380). If you would like to remain anonymous, you can report your concerns online by visiting the Dean of Students website at <https://www.uvm.edu/studentaffairs>

Final Exam Policy

The University final exam policy outlines expectations during final exams and explains timing and process of examination period. <https://www.uvm.edu/registrar/final-exams>

Statement on Alcohol and Cannabis in the Academic Environment

As a faculty member, I want you to get the most you can out of this course. You play a crucial role in your education and in your readiness to learn and fully engage with the course material. It is important to note that alcohol and cannabis have no place in an academic environment. They can seriously impair your ability to learn and retain information not only in the moment you may be using, but up to 48 hours or more afterwards. In addition, alcohol and cannabis can:

- Cause issues with attention, memory and concentration
- Negatively impact the quality of how information is processed and ultimately stored
- Affect sleep patterns, which interferes with long-term memory formation

It is my expectation that you will do everything you can to optimize your learning and to fully participate in this course.

Course Outline***Unit #1 – Fundamentals of Inorganic Chemistry***

- I. Molecular Symmetry
- II. Group Theory
- III. Molecular Orbital Theory
- IV. Main Group Bonding

Unit #2 – Coordination Complexes

- V. Acid-Base Chemistry
- VI. Solid State Chemistry
- VII. Transition Metal Bonding
- VIII. Ligand Field Theory

Unit #3 – Spectroscopy and Reactivity of Transition Metals

- IX. Electronic Spectroscopy
- X. Coordination Chemistry
- XI. Organometallic Chemistry
- XII. Bioinorganic Chemistry

Tentative Discussion Schedule			
	Monday	Wednesday	Friday
Aug. 31	Course Introduction	Proper Rotations (4.1)	Improper Rotations (4.1)
Sep. 7	Labor Day No Class	Point Groups (4.2) PS #1 Due	Character Tables (4.3)
Sep. 14	Molecular Vibrations (4.4)	Vibrational Spectroscopy (4.4) PS #2 Due	LCAO-MO (5.1)
Sep. 21	Homonuclear Diatomics (5.2)	MO Mixing (5.2) PS #3 Due	Heteronuclear Diatomics (5.3)
Sep. 28	Main Group σ Bonding (5.4)	Main Group π Bonding (5.4) PS #4 Due	Exam #1
Oct. 5	Lewis Acid-Base (6.4)	Hydrogen Bonding (6.5)	Hard-Soft Acid-Base (6.6) PS #5 Due
Oct. 12	Solid State Structure (7.1)	Band Structure (7.3)	Superconductivity (7.4) PS #6 Due
Oct. 19	Magnetism (10.1)	Metal σ Bonding (10.3)	Metal π Bonding (10.3) PS #7 Due
Oct. 26	Spin States (10.3)	Angular Overlap Model (10.4)	Jahn-Teller (10.5) PS #8 Due
Nov. 2	Exam #2	Term Symbols (11.2)	Selection Rules (11.3)
Nov. 9	Tanabe-Sugano (11.3) PS #9 Due	O_h Substitution (12.1-12.3)	D_{4h} Substitution (12.6-12.7)
Nov. 16	Redox Reactions (12.8) PS #10 Due	Oxidative Addition (14.1)	Insertion Reactions (14.2)
Nov. 23	Catalysis (14.3) PS #11 Due	Thanksgiving Recess No Class	Thanksgiving Recess No Class
Nov. 30	Metal Tetrapyrroles (16.1)	Metalloproteins (16.3)	Iron-Sulfur Clusters (16.4) PS #12 Due

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