

Chem 6510
Group Theory and Its Application in Chemistry
Fall 2021

Instructor: Dr. Gang Li

Office: ML359

Office Hours: By appointment (online or in-person)

Phone: 435-797-0604

Email: gang.li@usu.edu (best way to contact me)

Class Time: TBA

Deliver Method: Hybrid

In-Person: TBA (Mask Recommended)

Online: Zoom via Canvas, notification will be sent in advance if a lecture will be delivered online.

COVID Precautions:

USU is encouraging everyone to wear a mask in class. I will be wearing a mask during our meetings.

A COVID vaccine is the most powerful tool we currently have against infection. If you haven't yet been vaccinated, I urge you to consider getting the vaccine.

If you are sick (even mild symptoms), don't come to class. Let me know and I will make sure you get to participate.

If you think you have COVID, please get tested. USU offers free testing to all students, staff and faculties. Please refer to <https://www.usu.edu/covid-19/testing/index>.

If you stay home sick, test positive for COVID or are exposed to someone who has COVID, fill out the questionnaire on the top right of the page <https://www.usu.edu/covid-19/testing/index>. You will be sent instructions on what to do.

Course Content:

The purpose of this course is to provide fundamental knowledge of group theory in chemistry. The defining properties of a group will be discussed. Molecular symmetry, symmetry operations and representation of groups will be taught. The use of group theory in chemistry, including molecular orbital theory, molecular vibrations and spectroscopy will be discussed.

Prerequisites: Chem 3070

Required Text: None (Materials will be made available via Canvas)

Reference Textbooks:

a) *Chemical Application of Group Theory*, 3rd Edition, F. A. Cotton, John Wiley and Sons. 1990

Grading: A total of 300 points is possible. Points are distributed as follows:

Problem Sets (3 × 50 pts)	150 pts
Class Performance	50 pts
Final Exam	100 pts

Tentative Grading Scale:

A/A-	B+/B/B-	C+/C/C-	D+/D
90%-100%	80%-89%	70%-79%	60%-69%

Scales could be lowered based on overall class performance but will *not* be *raised*.

Class Performance

50 points will be distributed to class performance, which will be based on in-class questions, in-class discussion, etc.

Problem Sets and Exams

3 problem sets will be assigned throughout the semester. You will have a whole week to finish the problem set after it's posted. Final exams (tentatively take-home format, subject to change) will be given during on December 13th to December 17th, 2021.

Topic Outlines and Objectives

Topic 1: General Introduction

Topic 2: Definitions and Theorems of Group Theory

- The defining properties of a group
- Subgroups
- Classes

Topic 3: Molecular Symmetry

- Symmetry elements and operations
- The symmetry point groups

Topic 4: Representations of Groups

- Reducible representation and irreducible representation
- Character Tables

Topic 5: Applications of Group Theory in Chemistry

- Molecular Orbitals
- Molecular Vibrations
- Spectroscopy

Course Schedule

Week	Topic	Problems and Exams
1 (08/30-09/03)	Topic 1	
2 (09/06-09/10)	Topic 2-1	
3 (09/13-09/17)	Topic 2-2	
4 (09/20-09/24)	Topic 3-1	
5 (09/27-10/01)	Topic 3-2	
6 (10/04-10/08)	Topic 3-3	Problem Set 1
7 (10/11-10/15)	No Class (Fall Break)	
8 (10/18-10/22)	Topic 4-1	
9 (10/25-10/29)	Topic 4-2	
10 (11/01-11/05)	Topic 4-3	Problem Set 2
11 (11/08-11/12)	Topic 5-1	
12 (11/15-11/19)	Topic 5-2	Problem Set 3
13 (11/22-11/26)	No Class (Thanksgiving)	
14 (11/29-12/03)	Topic 5-3	
15 (12/06-12/10)	Topic 5-4	
16 (12/13-12/17)	No Class	Final Exam

Academic Freedom and Professional Responsibilities

Academic freedom is the right to teach, study, discuss, investigate, discover, create, and publish freely. Academic freedom protects the rights of faculty members in teaching and of students in learning. Freedom in research is fundamental to the advancement of truth. Faculty members are entitled to full freedom in teaching, research, and creative activities, subject to the limitations imposed by professional responsibility. [USU Policy 403](#) further defines academic freedom and professional responsibilities.

Academic Integrity - "The Honor System"

The University expects that students and faculty alike maintain the highest standards of academic honesty. The Code of Policies and Procedures for Students at Utah State University ([Student Conduct](#)) addresses academic integrity and honesty and notes the following:

Academic Integrity: Students have a responsibility to promote academic integrity at the University by not participating in or facilitating others' participation in any act of academic dishonesty and by reporting all violations or suspected violations of the Academic Integrity Standard to their instructors.

The Honor Pledge: To enhance the learning environment at Utah State University and to develop student academic integrity, each student agrees to the following Honor Pledge: "I pledge, on my honor, to conduct myself with the foremost level of academic integrity". Violations of the Academic Integrity Standard (academic violations) include, but are not limited to cheating, falsification, and plagiarism

Plagiarism

Plagiarism includes knowingly "representing by paraphrase or direct quotation, the published or unpublished work of another person as one's own in any academic exercise or activity without full and clear acknowledgment. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials." The penalties for plagiarism are severe. They include warning or reprimand, grade adjustment, probation, suspension, expulsion, withholding of transcripts, denial or revocation of degrees, and referral to psychological counseling.

Course Fees

Instructors that utilize course fees should identify the amount and explain the purpose of the course fee on the syllabus. Course fees are listed in the catalog.

Grievance Process

Students who feel they have been unfairly treated [in matters other than discipline, admission, residency, employment, traffic, and parking - which are addressed by procedures separate and independent from the Student Code] may file a grievance through the channels and procedures described in the Student Code: [Article VII Grievances](#)

Students with Disabilities

USU welcomes students with disabilities. If you have, or suspect you may have, a physical, mental health, or learning disability that may require accommodations in this course, please contact the Disability Resource Center (DRC) as early in the semester as possible (University Inn # 101, 435-797-2444, drc@usu.edu). All disability related accommodations must be approved by the DRC. Once approved, the DRC will coordinate with faculty to provide accommodations.

Withdrawal Policy, "I" Grade Policy and Dropping Courses

If a student does not attend a class during the first week of the term or by the second class meeting, whichever comes first, the instructor may submit a request to have the student dropped from the course. (This does not remove responsibility from the student to drop courses which they do not plan to attend.) Students who are dropped from courses will be notified by the Registrar's Office through their preferred e-mail account.

Students may drop courses without notation on the permanent record through the first 20 percent of the class. If a student drops a course following the first 20 percent of the class, a W will be permanently affixed to the student's record (check [General Catalog](#) for exact dates).

Students with extenuating circumstances should refer to the policy regarding Complete Withdrawal from the University and the Incomplete (I) Grade policy in the General Catalog.