

**Chemistry 515: Structure and Bonding in
Inorganic and Organometallic Chemistry
4 units**

Prof. Richard Brutchey
Fall 2023
(Lecture = 11:00-11:50 am MWF, SGM 226)

CHEM 515 is a graduate level course in Inorganic Chemistry. The intent of this course is to give you a comprehensive picture of structure and bonding in Inorganic Chemistry. The course will begin with a review of symmetry and group theoretical analysis. From there, we will develop a detailed picture of structure and bonding of discrete inorganic molecules using molecular orbital theory. Towards the end of the course, we will take these tools and extend them to an examination of structure and bonding in clusters and extended solids.

By the end of this course, students will be able to apply a working knowledge of group theory to describe the structure and bonding of inorganic complexes. They will be able to assign point groups to molecules and clusters and use symmetry to formulate qualitative molecular orbital diagrams to predict structure and reactivity. Students will be able to use concepts of molecular orbital theory to develop electronic band diagrams for extended solids and predict metallic vs. insulating behavior.

It is strongly recommended that students have successfully completed an upper-division undergraduate course in Inorganic Chemistry prior to enrolling in CHEM 515.

Required Texts: Cotton, *Chemical Applications in Group Theory*, 3rd ed.
Burdett, *Chemical Bonds: A Dialog*.

Supplemental Text: Hoffmann, *Solids and Surfaces: A Chemist's View of Bonding in Extended Structures*.

Office/Contact: RLB (brutchey@usc.edu) Office hours = virtual, by appointment only.

Grading*:

Hour Exams (×3):	75% (tentatively set for 9/29, 11/3, and 12/1)
Written Assignment:	20% (due 12/6 at 12:00 pm)
In-Class Participation:	5%

Grading for CHEM 515 is curved against historical point totals for this course. Cumulative point totals less than or equal to two standard deviations below the historical mean will result in a course grade of B– or lower.

** There will be absolutely no make ups, extra time, or special arrangements given for any exams or assignments without a properly documented excuse.*

Outline:

- I. Periodic table & periodic trends
- II. Group theory analysis of molecular systems
- III. Application of molecular orbital theory to structure and bonding in inorganic molecules, clusters, and extended solids

Academic Conduct:

General principles of academic integrity include and incorporate the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by the instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. Please familiarize yourself with *SCampus* in Part B, Section 11, "Behavior Violating University Standards and Appropriate Sanctions" <https://policy.usc.edu/scampus-part-b/>.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call

studenthealth.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call

suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention and Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call

studenthealth.usc.edu/sexual-assault

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity, Equal Opportunity, and Title IX - (213) 740-5086 | Title IX – (213) 821-8298

equity.usc.edu

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following *protected characteristics*: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations. The university also prohibits sexual assault, non-consensual sexual contact, sexual misconduct, intimate partner violence, stalking, malicious dissuasion, retaliation, and violation of interim measures.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298

usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity, Equal Opportunity, and Title IX for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services and Programs - (213) 740-0776

osas.usc.edu/

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

Campus Support & Intervention - (213) 821-4710

campussupport.usc.edu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion at USC - (213) 740-2101

diversity.usc.edu

Information on events, programs and training, the Provost’s Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.