

# Chemistry 307

## Inorganic Chemistry

Spring 2023

Instructor: Dr. Colin Gates, Flanner Hall 022; Ext. 83091; E-mail: [cgates4@luc.edu](mailto:cgates4@luc.edu)

Lecture: M, W and F 12:35 – 1:25 p.m. (Section 001); Cuneo Hall 002

Discussion: M 1:40 – 2:30 p.m. (Section 002) and 2:45-3:35 p.m. (Section 003); Flanner Hall 105

Office Hours: To be determined by poll Week 1 of class; Friday 9:30-11:00 until then.

Class Pre-requisite: Chem 222 or 224 and 226

Course Format: This course is primarily in-person; however, lectures will be livestreamed via Zoom and **recorded** via Panopto. Students are encouraged to attend lecture in-person as those who do not have, on average, performed worse in every class this instructor has taught in this format. Discussion is not recorded.

**Required Textbook**: Inorganic Chemistry, 7th Edition, M. Weller, T. Overton, J. Rourke and F. Armstrong, ISBN: 978-0-19-876812-8, Oxford University Press, 2018

Abbreviated solutions to self-tests and exercises from the book can be found online and in Sakai: [https://oup-arc.com/access/ichem7e-student-resources#tag\\_answers-to-self-test-questions](https://oup-arc.com/access/ichem7e-student-resources#tag_answers-to-self-test-questions)

**Recommended Materials**: Molecular Model Kit, ISBN-09648837-0-8 (2001), by Stephen Darling (see [www.molecularvisions.com](http://www.molecularvisions.com) or [www.darlingmodels.com](http://www.darlingmodels.com)). Model kits for organic chemistry classes usually do not contain many pieces for constructing octahedral and trigonal bipyramidal shapes, etc. which are common in inorganic chemistry. The Darling kit is somewhat flimsy and there are now comparably priced alternatives on Amazon, as well as supplementary kits for your standard organic model kit which have atom spheres with 5 and 6 holes for bonds. Also feel free to use the free website <https://symotter.org/> for visualization of symmetry elements and assignments of point groups.

**Course Description and Learning Outcomes**: Master basic concepts in inorganic chemistry, such as structure and bonding, transition metal chemistry and organometallics, as well as learning the basis for the role of metal ions in biological systems. This course is intended for Biochemistry majors and accordingly is focused on biologically relevant applications of inorganic chemistry. Specific topics are given below along with the order of coverage during the semester.

**Sakai and Lecture Notes:** The slides that are used for any given day's instruction will be posted on Sakai at least 48 hours before the relevant class to the best of the instructor's ability.

**Grading Policy:** 100 points for each of the *two 50-min exams*, 25 points for each of the *four 15-min quizzes*, and 200 points for *the final exam* for a grand total of 500 points. The exams will consist of multiple-choice and short-answer questions, but the quizzes will only contain multiple-choice questions. The final exam will be comprehensive with 60% covering material since Exam II and the remaining 40% on the material from Exams I and II. No makeup exams or quizzes will be given. For missed exams, a **written** doctor's or judge's excuse, or a letter from a funeral director, or a notification of a Medical School interview is required; the score for a missed exam or quiz will be determined from the scaled scores on the other exams and quizzes. Exceptions are, however, made for Students involved in Co-Curricular Activities. In those cases, the Loyola University Absence Policy is followed:

Students missing classes while representing Loyola University Chicago in an official capacity (e.g. intercollegiate athletics, debate team, model government organization) shall be allowed by the faculty member of record to make up any assignments and to receive notes or other written information distributed in the missed classes. Students should discuss with faculty the potential consequences of missing lectures and the ways in which they can be remedied. It is the responsibility of the student to make up any assignments. If the student misses an examination, the instructor is required to give the student the opportunity to take the examination at another time. Students must provide their instructors with proper documentation describing the reason for and date of the absence: <https://www.luc.edu/athleteadvising/attendance.shtml>. This documentation must be signed by an appropriate faculty or staff member, and it must be provided as far in advance of the absence as possible.

**Class Grades:** Total raw scores will also be used to establish final letter grades:

A = 100-85; A- = 84-80; B+ = 79-75; B = 74-70; B- = 69-65; C+ = 64-60; C = 59-55; C- = 54-50; D = 49-40; F = Less than 40

**Final Exam:** The University sets the schedule for all final exams. The final will be held on Friday, 5/5/2022, 9-11 AM. You will have exactly 2 hours to complete the exam. Additional time will not be granted, even if you start late. There will be no final exams given at other times under any circumstance. Instructors may not reschedule final exams for a class for another day and/or time during the final exam period. There can be no divergence from the posted schedule of dates for final exams. Individual students who have four (4) final examinations scheduled for the same date may request to have one of those exams rescheduled. If a student reports having four final examinations scheduled for the same date, students should be directed to e-mail a petition to Adam Patricoski, Assistant Dean for Student Academic Affairs, CAS Dean's Office ([apatricoski@luc.edu](mailto:apatricoski@luc.edu)).

### **Course Repeat Rule**

Effective with the Fall 2017 semester, students are allowed only THREE attempts to pass Chemistry courses with a C- or better grade. The three attempts include withdrawals (W). The Department advises that it is preferable to complete a course with a grade of C or C-, and to demonstrate growth in future coursework, than to withdraw from a course.

After the second attempt, the student must secure approval for a third attempt. Students must come to the Chemistry Department, fill out a permission to register form or print it from the Department of Chemistry & Biochemistry website: <https://www.luc.edu/chemistry/forms/> and personally meet and obtain a signature from either the Undergraduate Program Director, Assistant Chairperson, or Chairperson in Chemistry. A copy of this form is then taken to your Academic Advisor in Sullivan to secure final permission for the attempt.

**Course/Instructor Evaluation:** After the withdrawal deadline (Monday, March 28th) and up to the last day of classes, students will be given the opportunity to evaluate both the instructor and the course by using an online survey. Towards the end of the course, you will receive an email from the Office of Institutional Effectiveness to provide feedback on the course. You will receive consistent reminders throughout the period when the evaluation is open, and the reminders will stop once you have completed the evaluation. The evaluation is completely anonymous. When the results are released, instructors and departments will not be able to tell which student provided the individual feedback. Because it is anonymous and the results are not released to faculty or departments until after grades have been submitted, the feedback will not impact your grade. The feedback is important so that the instructor can gain insight into how to improve teaching and the department can learn how best to shape the curriculum. The essential objective for this course is “Gaining a basic understanding of the subject (*e.g.*, factual knowledge, methods, principles, generalizations, theories)”, and the important objective is “Learning to apply course material (to improve thinking, problem solving, and decisions).”

CHEM 307 is an advanced upper-level class and, for Private Tutoring, you may wish to seek the help of an advanced student who has successfully completed the course or of a graduate student who is conducting research in the area of inorganic chemistry.

**Student Accommodations:** Loyola University provides reasonable accommodations for students with disabilities. Any student requesting accommodations related to a disability or other condition is required to register with Student Accessibility Center (SAC), located in Sullivan Center, Suite 117. Professors receive the accommodation notification from SAC via Accommodate. Students are encouraged to meet with their professor individually in order to discuss their accommodations. All information will remain confidential. Please note that in this class, software may be used to record class lectures in order to provide equal access to students with disabilities. Students approved for this accommodation use recordings for their personal study only and recordings may not be shared with other people or used in any way against the faculty member, other lecturers, or students whose classroom comments are recorded as part of

the class activity. Recordings are deleted at the end of the semester. For more information about registering with SAC or questions about accommodations, please contact SAC at 773-508-3700 or [SAC@luc.edu](mailto:SAC@luc.edu).

**Academic Integrity:** All students in this course are expected to have read and to abide by the demanding standard of personal honesty, drafted by the College of Arts & Sciences, which can be viewed at: <http://www.luc.edu/cas/advising/academicintegritystatement>

A basic mission of a university is to search for and to communicate the truth as it is honestly perceived. A genuine learning community cannot exist unless this demanding standard is a fundamental tenet of the intellectual life of the community. Students of Loyola University Chicago are expected to know, to respect, and to practice this standard of personal honesty. Academic dishonesty can take several forms, including, but not limited to cheating, plagiarism, copying another student's work, and submitting false documents.

Any instance of academic dishonesty will be reported to all relevant parties and may be grounds for penalties up to and including a grade of F in the class and/or a warning note on the permanent transcript within the scope of the course. Any student found cheating on any examination or quiz will receive a "0" for that assignment. Materials from the course cannot be shared outside the course for any reason without the instructor's written permission.

**Spring 2023 Masking Requirement:** Please wear a mask in any setting where there will be students tightly packed together. Students are encouraged to wear masks at all times in the class.

**Error Policy:** The instructor reserves the right to amend or correct this syllabus.

### **Schedule and Approximate Syllabus:**

Lecture #	Date	Topic	Reading
1	1/18	Course Introduction and Atomic Structure	Ch. 1
2Z	1/20	Shielding	Ch. 1
3	1/23	Atomic Properties	Ch. 1
4	1/25	Molecular Shapes and VSEPR	Ch. 2.1 – 2.3
5	1/27	Symmetry Elements	Ch. 3.1
6	1/30	Point Groups	Ch. 3.1
7	2/1	Polarity and Chirality	Ch. 3.3, 3.4

8	2/3	VB Theory of Diatomics and Polyatomics	Ch. 2.4 – 2.6
9	2/6	MO Theory of Homo- and Hetero-Diatomics	Ch. 2.7 – 2.9
10	2/8	MO Theory of Polyatomics	See Power Points
11	2/10	Acids and Bases	See Power Points
12	2/13	Nomenclature of Coordination Compounds	Ch. 7.1, 7.2
	2/15	Review	
	2/17	EXAM I (Lectures 1 – 10)	
13Z	2/20	Coordination Numbers	Ch. 7.3 – 7.6
14	2/22	Isomerism of Coordination Compounds	Ch. 7.7 – 7.10
15	2/24	Crystal Field Theory	Ch. 20.1
16	2/27	Crystal Field Theory (cont.)	Ch. 20.1
17	3/1	Magnetochemistry	Ch. 20.1, 20.8
18	3/3	Crystal Field Theory (cont.)	Ch. 20.1
19	3/13	Ligand Field Theory	Ch. 20.2
20	3/15	Term Symbols	Ch. 20.3
	3/17	Review	
	3/20	EXAM II (Lectures 11 – 19)	
21	3/22	Electronic Spectra	Ch. 20.4 – 20.6
22	3/24	Electronic Spectra (cont.)	Ch. 20.4 – 20.6
23	3/27	Electronic Spectra (cont.)	Ch. 20.4 – 20.6
24	3/29	Substitution Reactions in $O_h$ Complexes	Ch. 21.1-21.2, 21.6 – 21.7
25	3/31	Substitution Reactions in $D_{4h}$ Complexes	Ch. 21.3 – 21.4
26	4/3	Electron Transfer Reactions	Ch. 21.10 – 21.12
27	4/5	Bioinorganic Chemistry	Ch. 26
28	4/12	Bioinorganic Chemistry (cont.)	Ch. 26

29Z	4/14	Bioinorganic Chemistry (cont.)	Ch. 26
30	4/17	Metals in Medicine	Ch. 27
31	4/19	Metals in Medicine (other)	See Power Points
32	4/21	18-e <sup>-</sup> Rule and Organometallic Compounds	Ch. 22.1-22.4
33	4/23	Carbonyl and $\pi$ -donor Complexes	Ch. 22.5-14, 22.17, 22.18g
34	4/26	Organometallic Rxns & Catalysis	Ch.22.21-26, 22.28, 22.32
	4/28	Review	

The final examination date: 5/5/2022 Friday, 9 - 11 am (60% on Lectures 20 – 34; 20% on Lectures 1 – 10, and 20% on Lectures 11 – 19).

Discussions will be held on Mondays after class and will cover topics from the previous week. Lectures noted with a “Z” are expected to be on Zoom due to the instructor’s service commitments.

**Important Dates:**

Jan. 17<sup>th</sup>: Classes begin.

Jan. 23<sup>rd</sup>: Add/drop ends at midnight.

Jan. 30<sup>th</sup>: Last day to withdraw without a “W.”

Mar. 6-11: Spring break.

Mar. 27<sup>th</sup>: Last day to withdraw with a “W.”

Apr. 6-10: Easter break.

Apr. 28<sup>th</sup>: End of classes.