

Chemistry 307

Inorganic Chemistry

Spring 2024

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

Lecture: M, W, and F 12:35 – 1:25 p.m. (Section 001); Flanner Hall 105

Discussion: M 11:30 – 12:20 p.m. (Section 002); 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 (old system) or Chem 240 and 242 (new system)

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.

Textbook: Inorganic Chemistry, 7th Edition, M. Weller, T. Overton, J. Rourke and F. Armstrong, ISBN: 978-0-19-876812-8, Oxford University Press, 2018. Textbook is strongly recommended and available from the bookstore and via the university library online, or via other sellers. Older versions are available more cheaply but may disadvantage users.

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

Recommended Materials: Molecular Model Kit, ISBN-09648837-0-8 (2001), by Stephen Darling (see www.molecularvisions.com or 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:

Loyola University Absence Policy for Students in Co-Curricular Activities (including ROTC):

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. Students must provide their instructors with proper documentation i.e., "Athletic Competition & Travel Letter" describing the reason for and date of the absence.

This documentation must be signed by an appropriate faculty or staff member and it must be provided to the professor in the first week of a semester. It is the responsibility of the student to make up any assignments. If the student misses an examination, the instructor is required to allow the student to take the examination at another time. (<https://www.luc.edu/athletheadvising/attendance.shtml>)

Students who will miss class for an academic competition or conference must provide proper documentation to their instructor as early in the semester 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- = 54-52; D+ = 51-50; 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, 5/3/2024, 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).

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.

Pass/Fail Conversion Deadlines and Audit Policy

A student may request to convert a course into or out of the “Pass/No-Pass” or “Audit” status only within the first two weeks of the semester. For the Spring 2024 semester, students can convert a class to “Pass/No-Pass” or “Audit” through Monday, January 29th. Students must submit a request for Pass/No-Pass or Audit to their Academic Advisor.

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.

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.

Regarding the use of Artificial Intelligence: our Provost has expressed to “Let us all make sure we are learning and sharing best practices and not allowing AI to do the learning for us.” In this course, any work you submit for credit must represent your own ideas and understanding of the

assigned material. If you are uncertain about any case where your use of AI may be in conflict with University or course standards, please see me to discuss your concerns.

Masking Policy: Students are encouraged to wear a mask in any setting where there will be students tightly packed together or if there is any chance of having a respiratory illness.

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

Schedule and Approximate Syllabus:

Lecture #	Date	Topic	Reading
1	1/17	Course Introduction and Atomic Structure	Ch. 1
2	1/19	Shielding	Ch. 1
3	1/22	Atomic Properties	Ch. 1
4	1/24	Molecular Shapes and VSEPR	Ch. 2.1 – 2.3
5	1/26	Symmetry Elements	Ch. 3.1
6	1/29	Point Groups	Ch. 3.1
7	1/31	Polarity and Chirality	Ch. 3.3, 3.4
8	2/2	VB Theory of Diatomics and Polyatomics	Ch. 2.4 – 2.6
9	2/5	MO Theory of Homo- and Hetero-Diatomics	Ch. 2.7 – 2.9
10	2/7	MO Theory of Polyatomics	See Power Points
11	2/9	Acids and Bases	See Power Points
12	2/12	Nomenclature of Coordination Compounds	Ch. 7.1, 7.2
	2/14	Review	
	2/16	EXAM I (Lectures 1 – 10)	
13	2/19	Coordination Numbers	Ch. 7.3 – 7.6
14	2/21	Isomerism of Coordination Compounds	Ch. 7.7 – 7.10
15	2/23	Crystal Field Theory	Ch. 20.1
16	2/26	Crystal Field Theory (cont.)	Ch. 20.1

17	2/28	Magnetochemistry	Ch. 20.1, 20.8
18	3/1	Crystal Field Theory (cont.)	Ch. 20.1
19	3/11	Ligand Field Theory	Ch. 20.2
20	3/13	Term Symbols	Ch. 20.3
	3/15	Review	
	3/18	EXAM II (Lectures 11 – 19)	
21	3/20	Electronic Spectra	Ch. 20.4 – 20.6
22	3/22	Electronic Spectra (cont.)	Ch. 20.4 – 20.6
23	3/25	Electronic Spectra (cont.)	Ch. 20.4 – 20.6
24	3/27	Substitution Reactions in O_h Complexes	Ch. 21.1-21.2, 21.6 – 21.7
25	4/3	Substitution Reactions in D_{4h} Complexes	Ch. 21.3 – 21.4
26	4/5	Electron Transfer Reactions	Ch. 21.10 – 21.12
27	4/8	Bioinorganic Chemistry	Ch. 26
28	4/10	Bioinorganic Chemistry (cont.)	Ch. 26
29Z	4/12	Bioinorganic Chemistry (cont.)	Ch. 26
30	4/15	Metals in Medicine	Ch. 27
31	4/17	Metals in Medicine (other)	See Power Points
32	4/19	18- e^- Rule and Organometallic Compounds	Ch. 22.1-22.4
33	4/22	Carbonyl and π -donor Complexes	Ch. 22.5-14, 22.17, 22.18g
34	4/24	Organometallic Rxns & Catalysis	Ch.22.21-26, 22.28, 22.32
	4/26	Review	

The final examination date: 5/3/2024 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. 16th: Classes begin.

Jan. 22nd: Add/drop ends at midnight.

Jan. 29th: Last day to withdraw without a “W.”

Mar. 4-9: Spring break.

Mar. 25th: Last day to withdraw with a “W.”

Mar. 28th-Apr. 1st: Easter break.

Apr. 26th: End of classes.

Disclosures for the Course, Format, and Department Policies**Syllabus Statement**

In this class software will be used to record live class discussions. As a student in this class, your participation in live class discussions will be recorded. These recordings will be made available only to students enrolled in the class, to assist those who cannot attend the live session or to serve as a resource for those who would like to review content that was presented. All recordings will become unavailable to students in the class when the Sakai course is unpublished (i.e. shortly after the course ends, per the [Sakai administrative schedule](#)). Students who prefer to participate via audio only will be allowed to disable their video camera so only audio will be captured. Please discuss this option with your instructor.

The use of all video recordings will be in keeping with the University Privacy Statement shown below:

Privacy Statement

Assuring privacy among faculty and students engaged in online and face-to-face instructional activities helps promote open and robust conversations and mitigates concerns that comments made within the context of the class will be shared beyond the classroom. As such, recordings of instructional activities occurring in online or face-to-face classes may be used solely for internal class purposes by the faculty member and students registered for the course, and only during the period in which the course is offered. Students will be informed of such recordings by a

statement in the syllabus for the course in which they will be recorded. Instructors who wish to make subsequent use of recordings that include student activity may do so only with informed written consent of the students involved or if all student activity is removed from the recording. Recordings including student activity that have been initiated by the instructor may be retained by the instructor only for individual use.

Students may only download *any* materials from this course with the express written permission of the instructor to avoid liability for copyright and intellectual property violations students may otherwise be committing.

Accommodations for Religious Reasons

If you have observances of religious holidays that will cause you to miss class or otherwise affect your performance in the class you must alert the instructor within 10 calendar days of the first class meeting of the semester (by January 27th, 2024) to request special accommodations, which will be handled on a case by case basis.