

Syllabus and General Information

CHEM4020 – Advanced Inorganic Chemistry

Fall 2024 TR 9:30-10:45a.m. Location: GILMAN 1652

Lecture--3 hours. Prerequisite: CHE301 or consent of instructor.

Website: www.canvas.iastate.edu

Prof. Kirill Kovnir kovnir@iastate.edu

Office Hours: TR 11am-12pm (Hach 3122) or by appointment

T.A. Ernesto Soto esoto20@iastate.edu

Office Hours: by appointment.

Recommended textbooks:

"Inorganic Chemistry", 7th Ed., Weller, Overton, Rourke, Armstrong, 2018

eBook: ISBN 9780192522955, via Redshelf, VitalSource, ISBN 9780198768128

This course is enrolled in the Iowa State University Immediate Access Program providing electronic access via Canvas. See FAQ here: <https://www.isubookstore.com/immediate-access>

You have a choice to **opt-out within the first 10 days of classes.**

Other Books which might be useful for the understanding of topic:

J. S. Ogden "Introduction to Molecular Symmetry", Oxford, ISBN: 9780198559108.

N.N. Greenwood, A. Earnshaw: Chemistry of the Elements, 2nd Edition, Butterworth-Heinemann, Oxford, 1997, ISBN: 0750633654

D. M. P. Mingos, *Essential Trends in Inorganic Chemistry*. Oxford University Press, 1998. ISBN-10: 0198501080

Useful Resources:

Symmetry: <https://symotter.org/tutorial/intro>

Packing and Solids: <https://crystals.symotter.org/>

Periodic Table: <http://www.webelements.com/>

Orbitals: <http://winter.group.shef.ac.uk/orbitron/AOs/6s/e-density.html>

Str&Bond. <http://www.chemtube3d.com/Organic%20Structures%20and%20Bonding.html>

CHE402 Learning Goals: This course will continue discussion of basics of chemistry, chemical bonding, with emphasis on the of the *d*- and *f*-metals. Structure, bonding, vibrational and electronic spectra of molecular and solid compounds containing *d*- and *f*-metals, aspects of solid state and bioinorganic chemistry will be discussed.

Lectures: You are expected to **attend regularly** and to read the available material (textbook and lecture notes) before the lecture. Not everything covered in lectures is present in the book and/or lecture notes. **The lecture notes and problem sets should be your primary guide as to what topics to study for exams.** Lecture slides and recordings will be available on Canvas.

Podcasts and slides are not intended to be substitutes of in class activities, rather materials for review or make up.

TopHat– recommended www.tophat.com Join Code: **125035**

We will use TopHat system for in-class activities. It is your responsibility to register and provide an electronic device which can operate TopHat. It will operate on most smartphones, tablets, and laptops. Your answers to the questions during lectures will be used as a reason to make up for missing points for your homework assignments.

Date(s)	Topic	Text	Approx. Due
Aug. 27, 29, Sept. 3, 5, 10, 12, 17	Review of 301; Electronic configurations and term symbols; Crystal field & ligand field theories; Electronic absorption spectra	Chs.: 1, 2, 9, 20	HW1: Sept. 5
Sept. 19	EXAM 1 (Electronic configurations)		
Sept. 24, 26, Oct. 1, 3, 8, 10, 15, 17	Symmetry and Group Theory; Transition metal complexes; MO theory applied to d-orbitals; Magnetic properties; Structural analysis methods	Chs.: 3, 8, 20	HW2: Sept. 26 HW3: Oct. 8
Oct. 22	EXAM 2 (MO Theory)		
Oct. 24, 29, 31 Nov. 5, 7, 12, 14, 19	Vibrational Spectroscopy; Solid state inorganic chemistry; Applications: Batteries and superconductors	Chs.: 3, 4, 24	HW4: Oct. 31 HW5: Nov. 12
Nov. 21	EXAM 3 (Solid state and vibr. spectroscopy)		
Nov 25-29	Thanksgiving Break		
Dec. 3, 5, 10, 12	Chemistry of <i>f</i> -elements; Bioinorganic Chemistry, Review of all material	Chs.: 23, 26	
Dec. 17, 9.45-11.45 am	<i>FINAL EXAM</i> (cumulative)		

This is the approximate schedule of topics covered in lectures. **The lecture notes and problem sets should be your primary guide as to what topics to study for exams.** Lectures will summarize significant points from the reading but may not cover all material in the reading. Additional material will be included in the lectures which is not present in the textbook. Lecture notes will be posted on Canvas. Nonetheless, the assigned reading is a part of this course's material. Specific amendments to readings and topics and other important announcements will be presented at the *start of each lecture.*

Homework. Each homework assignment will be due on the specific day (see approx. dates in the Table above) at 2pm. No late assignments will be accepted without some approved advanced notice. In your answers, write legibly. Feel free to work with other students on the homework, but you must turn in your own individual set of solutions. All work must be shown to receive full credit. Each homework assignment will be worth a total of 20 points. Solutions to the homework will be posted on Canvas after the due date. After the Key to HW is published no late submissions are possible.

EXAMS. Three exams (100 points each) will be given during the assigned class times on Sept. 19, Oct. 22, and Nov. 21. Each exam emphasizes topics preceding the exam date and involves a mixture of short answers and problem solving, including writing brief explanations. Make sure you understand, and can work, all the assigned problems and relevant examples in the homework, and any problems that are presented in class. A two-hours comprehensive final exam (300 points) is scheduled for Tuesday, Dec. 17, 9:45-11.45 am in the same room, GILMAN 1652.

FINAL GRADE. The final grade is based on three midterm exams (100 points each), a final exam (300 points), and completed homework sets (5×20=100 points). Tentative grade assignments (based on percentages) are A-/A, 90-100%; B-/B/B+, 75-90%; C-/C/C+, 60-75%; D-/D/D+, 50-60%; F, 0-50%. Within these limits, I reserve the right to exercise discretion in deciding the exact cutoff.

Attendance Policy: All students are expected to attend lectures and be prepared. Absences due to documented illness, deaths in the immediate family and other documented crises, calls to active military duty or jury duty, religious holydays, and official University activities will be accommodated by the instructor. Consideration will also be given to students whose dependent children experience serious illness. All students are expected to abide by this class attendance policy. Students must also provide, when possible, advance notice of absences as well as relevant documentation regarding absences to the instructor as soon as possible following the illness or event that led to an absence. **Regardless of whether an absence is excused or unexcused, the student is responsible for making up all work that is missed and following the announcements made in missed class. Only university excused absences, however, will grant a student the chance of making up a missed exam.**

Accessibility Statement: Iowa State University is committed to advancing equity, access, and inclusion for students with disabilities. Promoting these values entails providing reasonable accommodations where barriers exist to students' full participation in higher education. Students in need of accommodations or who experience accessibility-related barriers to learning should work with Student Accessibility Services (SAS) to identify resources and support available to them. Staff at SAS collaborate with students and campus partners to coordinate accommodation and to further the academic excellence of students with disabilities. Information about SAS is available online at www.sas.dso.iastate.edu, by email at accessibility@iastate.edu, or by phone at 515-294-7220.

Discrimination and Harassment: Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3410 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515-294-7612, Hotline 515-294-1222, email eoffice@iastate.edu

Academic Dishonesty: The class will follow Iowa State University's policy on academic misconduct ([5.1 in the Student Code of Conduct](#)). Students are responsible for adhering to university policy and the expectations in the course syllabus and on coursework and exams and for following directions given by faculty, instructors, and ISU Test Center regulations related to coursework, assessments, and exams. Anyone suspected of academic misconduct will be reported to the [Office of Student Conduct in the Dean of Students Office](#). Information about academic integrity and the value of completing academic work honestly can be found in the [Iowa State University Academic Integrity Tutorial](#). Academic misconduct in any form will not be tolerated. This includes but is not limited to copying or sharing answers on tests or assignments, plagiarism, and having someone else do your academic work. Depending on the act, a student could receive an F grade on the test/assignment, F grade for the course, and could be suspended or expelled from the University. *Students are encouraged to work together*; however, students are not allowed to copy data or calculations from others.

Free Expression: Iowa State University supports and upholds the First Amendment protection of freedom of speech and the principle of academic freedom in order to foster a learning environment where open inquiry and the vigorous debate of a diversity of ideas are encouraged. Students will not be penalized for the content or viewpoints of their speech as long as student expression in a class context is germane to the subject matter of the class and conveyed in an appropriate manner.

No employee, student, applicant, or campus visitor is compelled to disclose their pronouns. Anyone may voluntarily disclose their own pronouns.

Mental Health and Well-Being Resources: At Iowa State, we're committed to your success and well-being. As a Cyclone, you can access 24/7 resources, services, and people dedicated to helping you achieve your goals and be your best in and out of the classroom. Whether you need academic support or just someone to talk to, we're here for you at Cyclone Support (cyclonesupport.iastate.edu). If you are struggling emotionally and need support, there's confidential help available 24/7/365. You can call or text 988 or use the chat at 988lifeline.org.

Religious Accommodations: Iowa State University welcomes diversity of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request reasonable accommodation for religious practices. In all cases, you must put your request in writing ahead of time, at least one week in advance. The instructor will review the situation in an effort to provide a reasonable accommodation when possible to do so without fundamentally altering a course. For students, you should first discuss the conflict and your requested accommodation with your professor at the earliest possible time. You or your instructor may also seek assistance from the [Dean of Students Office](#) at 515-294-1020 or the [Office of Equal Opportunity](#) at 515-294-7612.

Classroom etiquette: Cell-phone use for other than teaching purposes, i.e. operation of TopHat, during lectures is strictly forbidden. Students who read/watch/post online content, carry on extended conversations during lecture, use electronic devices for other than academic purposes will be asked to leave the room. **During exams cellphone and communication device use will result in a zero grade.**

Communication between the instructor (professor and TA) and the students on Canvas and via Canvas email: You are encouraged to contact me via email to inform me about your absence and with questions pertaining to chemistry. You are also encouraged to check your ISU email daily as I may contact the class with important information. We will use Canvas to upload lecture notes, homework assignments, exam keys, and any other material.

Instructor receives tons of e-mail everyday: please write "Chem4020" in the subject line of your email to ensure proper reading and timely answering.