Syllabus and General Information

CHEM402 – Advanced Inorganic Chemistry

Fall 2022   TR 9:30-10:45a.m. Location: GILMAN 0312

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

Website: www.canvas.iastate.edu

Prof. Kirill Kovnir   kovnir@iastate.edu

Office Hours: online TR 11am-12pm or by appointment via Webex

T.A. TBD

Office Hours: TR 11am-noon or by appointment.

Recommended textbooks:
"Inorganic Chemistry", 7th Ed., Weller, Overton, Rourke, Armstrong, 2018
eBook: ~$80, ISBN 9780192522955, via Redshelf, Vitalsource
Bound, soft cover: ~$160, 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 first 10 days.

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 introduce 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 (text-book and lecture notes) before 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 recording of each lecture will be available at Canvas. *Podcast and slides are not intended to be full substitutes of in class activities, rather materials for review or make up.*

TopHat– recommended www.tophat.com Join Code: **791649**

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 vast majority of smartphones, tablets, and laptops. Your answers on the questions during lectures will be used as a reason to make up for missing points to your homework assignments.

Date(s)	Topic	Text	HW Due
Aug. 23, 25, 30 Sept. 1, 6	Review of 301; Electronic configurations and term symbols; Crystal field & ligand field theories; Electronic absorption spectra	Chs.: 1, 2, 9, 20	HW1: Sept. 1
Sept. 8	*EXAM 1 (Electronic configurations)*		
Sept. 13, 15, 20, 22, 27, 29 Oct. 4, 6, 11	Symmetry and Group Theory; Transition metal complexes; MO theory – d-orbitals; Magnetic properties; Structural analysis methods	Chs.: 3, 8, 20	HW2: Sept. 20 HW3: Oct. 4
Oct. 13	*EXAM 2 (MO Theory and vibr. spectroscopy)*		
Oct. 18, 20, 25, 27 Nov. 1, 3, 8, 10, 15	Vibrational Spectroscopy; Solid state inorganic chemistry; Applications: Batteries and superconductors	Chs.: 3, 4, 24	HW4: Oct. 27 HW5: Nov. 8
Nov. 17	*EXAM 3 (Solid state and vibr. spectroscopy)*		
Nov 21-25	**Thanksgiving Break**		
Nov. 29 Dec. 1, 6, 8	Chemistry of f-elements; Bioinorganic Chemistry, Review of all material	Chs.: 23, 26	
Dec. 13, 9.45-11.45 am	*FINAL EXAM* (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 at the specific day (see approx. dates in the Table above) at the *start* of the lecture period. 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.

EXAMS. Three hour-long exams (100 points each) will be given during the assigned class times on Sept. 8, Oct. 13, and Nov. 17. Each exam will emphasize topics preceding the exam date and will involve a mixture of short answer 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 Fri, Dec. 13th, 9:45-11.45 am in the same room, GILMAN 0312.

FINAL GRADE. The final grade is based on three hour-long exams (100 points each), a final exam (300 points), and completed homework sets (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 lecture and be prepared. Absences due to documented illness, deaths in the immediate family and other documented crises, call 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 assuring that all educational activities are free from discrimination and harassment based on disability status. Students requesting accommodations for a documented disability are required to work directly with staff in Student Accessibility Services (SAS) to establish eligibility and learn about related processes before accommodations will be identified. After eligibility is established, SAS staff will create and issue a Notification Letter for each course listing approved reasonable accommodations. This document will be made available to the student and instructor either electronically or in hard-copy every semester. Students and instructors are encouraged to review contents of the Notification Letters as early in the semester as possible to identify a specific, timely plan to deliver/receive the indicated accommodations. Reasonable accommodations are not retroactive in nature and are not intended to be an unfair advantage. Additional information or assistance is available online at www.sas.dso.iastate.edu, by contacting SAS staff by email at accessibility@iastate.edu, or by calling 515-294-7220. Student Accessibility Services is a unit in the Dean of Students Office located at 1076 Student Services Building.

Academic Misconduct: Academic Misconduct in any form is in violation of ISU *Student Disciplinary Regulations* and 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. See the Conduct Code at www.dso.iastate.edu/ja for more details and a full explanation of the Academic Misconduct policies. *Students are encouraged to work together,* however students are not allowed to copy data or calculations from any other person.

Free Expression: Iowa State University supports and upholds the First Amendment protection of freedom of speech and the principle of academic freedom 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.

Classroom etiquette: <u>Cell-phone use for other than teaching purposes, *i.e.* operation of TopHat, during lectures is strictly forbidden</u>. 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 cell-phone and communication device use will result in a zero grade.**

Communication between the instructor (professor and TA) and the students <u>on Canvas and *via* email</u>: You are encouraged to contact me via email to inform me about your absence and with questions pertaining 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.

I receive tons of e-mail everyday: please write "Chem402" in the subject line of your email to ensure proper reading and answering.