CH4310 Inorganic Chemistry I (3) Fall 2022

Instructor Information

Instructor:	**Rudy Luck**
Office Location:	Bldg 19- RM 701b
Telephone:	Office – (906) 487-2309
E-mail:	rluck@mtu.edu
Office Hours:	M, W & F 11:00 - 12:00 AM(office or zoom)

Course Identification

Course Number:	CH4310-L01
Course Name:	**Inorganic Chemistry I**
Course Location:	RM 19-106
Class Times:	M, W & F 10:00 - 10:50 AM
Prerequisites:	CH3520

COVID-19

The lectures will be held in RM 104b. The slides in class will be displayed using zoom, recorded, and uploaded to canvas. This recording will just feature PowerPoint slides and audio. It is not a video of the classroom. The recording and live presentation are necessary for the eventuality of quarantine or some other problem.

All students are expected to comply with University protocols in place to reduce the spread of COVID-19. Please consider wearing a face-covering indoors at all times and maintaining six-foot social distancing whenever possible.

Course Description/Overview

Descriptive chemistry of the main group elements with some emphasis on the non-metals. Transition metal compounds: aspects of bonding, spectra, and reactivity; complexes of n-acceptor ligands; organometallic compounds and their role in catalysis; metals in biological systems; preparative, analytical, and instrumental techniques.

Course Learning Objectives

The topics mentioned below will be covered in the lectures. You are responsible for all the material in the lectures, any notes or material handed out in class, and the appropriate sections covering material in the class described in the text.

General Outline.	
Background/Symmetry/Point groups	Crystal Field Theory
Acids/Super acids	Transition element chemistry
Hydrogen	Ligand Chemistry/Special topics
Halides	CO Compounds and olefins
NMR, especially multinuclear	Allyl
Group IA	Olefin Isomerization
Group IIA	Arenes and acetylene
Group IIIA	Oxidative addition reactions
Group IVA	Hydrogenation
Phosphorus	Various catalytic processes

- As a consequence of coverage of the topics listed in the general outline, you will have attained knowledge of all of them and be able to speak about the aspects of the chemistry within each topic.
- You will understand symmetry and how to derive point groups.
- You will learn about super acids and the chemistry of hydrogen.
- The theory of NMR is also covered in this course. What causes splitting in a spectrum and how to interpret the data is essential knowledge for this section.
- The chemistry of the main group elements and the alkali and alkali earths will be discussed with emphasis on industrial applications. You will need to remember the details of these.
- Crystal field theory deals with the imagined splitting of the d–orbitals which give rise to the colors of transition metal complexes. You will learn how to generate these given the geometry of a molecule.
- You will learn about the chemistry of the first-row transition elements and, time permitting, we will investigate ligand chemistry and the special topics listed above.
- You need to be able to recall all of the chemistry described together with the applicable mechanistic details to do the exams.
- Please note that a detailed listing of the topics listed above is given at the end of this syllabus.

Course Website(s)

- https://mtu.instructure.com/courses/1413936 mainly for listing completed lecture notes and scores.

Required/recommended Course Text

- Inorganic Chemistry (Seventh edition by Shriver, Weller, Overton, Rourke, and Armstrong) should be available in the bookstore. Some questions in problem sets will come from this text. Advanced Inorganic Chemistry (Sixth edition by Cotton and Wilkinson) is highly recommended for those serious about chemistry. The library also has several inorganic textbooks.
- You have to bring an iClicker to lectures since there will be graded quizzes. **The REEF system will also work and this applies to the Zoom lectures as well as in class.**

Course Supplies

Lecture notes and various documents are all available online on the canvas website for the course. The Cambridge Crystallographic DataBase program is available on university computers.

Grading Scheme

Letter Grade	***Percentage***	***Grade points/credit***	***Rating***
A	90-100	4.00	Excellent
AB	85-90	3.50	Very good
B	80-85	3.00	Good
BC	75-80	2.50	Above average
C	70-75	2.00	Average
CD	65-70	1.50	Below average
D	55-65	1.00	Inferior
F	55% and below	0.00	Failure
I	Incomplete; given only when a student is unable to complete a segment of the course because of circumstances beyond the student's control. A grade of incomplete may be given only when approved in writing by the department chair or school dean.		
X	Conditional, with no grade points per credit; given only when the student is at fault in failing to complete a minor segment of a course, but in the judgment of the instructor does not need to repeat the course. It must be made up within the next semester in residence or the grade becomes a failure (F). An (X) grade is computed into the grade point average as an (F) grade.		

Grading Policy

Grades will be based on the following:

Homework (3 assignments)	15
Exams (3 exams) (Sept. 23, Oct. 21, and Nov. 16)	36
Classroom clicker questions	9
End of lecture quizzes	10
Final	30
Total Points	**100**

The final exam in this course will be the ACS Foundations of Inorganic Chemistry exam. See more details on this below in the section entitled VIPER requirements.

Late Assignments

Late work is not accepted. Hand the assignments in on time.

Course Policies

Please disrupt the lecture as much as possible to correct mistakes or ask questions.

We are all members of an academic community where it is our shared responsibility to cultivate a climate where all students/individuals are valued and where both they and their ideas are treated with respect.

Michigan Tech is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help or to find additional resources, contact Counseling Services at 906-487-2538 or visit the Counseling Services website [http://www.mtu.edu/counseling].

Collaboration/Plagiarism Rules

Cell phones, Blackberries, iPods, PDAs, or any other electronic/recording devices can be freely used in the classroom but not during exams.

University Policies

Student work products (exams, essays, projects, etc.) may be used for purposes of the university, program, or course assessment. All work used for assessment purposes will not include any individual student identification.

Academic regulations and procedures are governed by University policy. Academic dishonesty cases will be handled following the University's policies.
If you have a disability that could affect your performance in this class or that requires an accommodation under the Americans with Disabilities Act, please see me as soon as

possible so that we can make appropriate arrangements. The Affirmative Action Office has asked that you be made aware of the following:
Michigan Technological University complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act of 1990. If you have a disability and need a reasonable accommodation for equal access to education or services at Michigan Tech, please call the Dean of Students Office at 487-2212. For other concerns about discrimination, you may contact your advisor, Chair/Dean of your academic unit, or the Affirmative Programs Office at 487-3310.

Academic Integrity:

Students who cheat, plagiarize or fabricate data as well as students who help others cheat, plagiarize or fabricate data will receive sanctions ranging from a warning to a failing grade to expulsion from the University, depending on the severity of the offense. Read and examine http://www.mtu.edu/conduct/integrity-center/students/index.html for the complete Academic Integrity Policy.
Affirmative Action and Institutional Equity: http://www.mtu.edu/equity/
Disability Services: http://www.mtu.edu/equity/access-disability/ada/
Per University policy and the Americans with Disabilities Act (ADA), academic accommodations may be made for any student who notifies the instructor of the need for accommodation. You must take the initiative to bring such needs to the instructor's attention, as he/she is not legally permitted to inquire about such particular needs of students. Students who may require special assistance in emergency evacuations (fire, tornado, etc.) should contact the instructor as to the most appropriate procedures to follow in such an emergency. Contact the Office of Affirmative Programs if you have any questions about issues related to the ADA at 487-3310

Equal Opportunity Statement:

http://www.mtu.edu/bot/governance/policies/chapter5/sections/5.01-5.05.html
In keeping with its responsibilities as an educational institution, Michigan Technological University is committed to a policy of affording equal opportunity to all of its employees, students, applicants for employment, and applicants for admission without regard to race, religion, color, national origin, age, sex, sexual orientation, gender identity, height, weight, genetic information, or marital status. The University is also committed to a policy of educating and employing disabled individuals and veterans without discrimination. These policies are to be implemented with due regard for the relative qualifications of all involved.

Course Schedule

We will cover the following topics as the days progress like sand through the hourglass.

Background-atomic structure, periodicity, chemical bonding, group valencies, molecular shapes, hybrid orbitals, the naming of compounds.
Chapter 1, 2, 3, 4, 9

Acids-definitions, oxyacids, superacids/magic acids.
Chapter 5

Hydrogen-periodicity, salt-like hydrides, formation, ionic lattices, simple covalent hydrides, properties, structural features, hydrogen bonding, ice, inter vs. intra H-atom bonding.
Chapter 10

Halides-group IV and group V, Group III, structures, hybridization, octet expansion, halide abstraction, autoionization, halides as Lewis acids.
Chapter 17

NMR-some theory, conducting the experiment, nuclear energy levels, multinuclear spectra (P, F, etc.)
Chapter 8

Crystal Field Theory-different systems, MO considerations, π-acid ligands, orders of the orbitals, backbonding considerations, paramagnetism, Cu-acetate complexes structure and bonding considerations, Jahn-Teller theorem, Co-complexes of CO vs. NO, bonding aspects,
Chapter 19, 20

Transition Element Chemistry: Ti 6 Cu-oxidation states and stabilization, Ti, Cu, V, VO bond, Cr, $Cr_2(acetate)_4$, Mn, MnO_4^-, Fe, Co, Ni. Essentially, an examination of some noteworthy compounds looking at synthesis, structure, and bonding.
Chapter 19, 21-22

Group I-general properties, lattice energy effects, Born-Haber cycle considerations, solvation effects, bidentate ligand chemistry, crown ethers chelation, cryptans, organolithium compounds structure, and bonding aspects.
Chapter 11

Group II-general properties, simple covalent molecules, aqueous chemistry with Be, unusual reactions, bonding considerations, Mg and Grignard reagents, structure, and bonding therein.
Chapter 12

Group III-covalent chemistry of B, halides of B, structure and bonding considerations, boron hydrides, extensive coverage of boranes, boron-nitrogen compounds, other Gp III elements, halides/Lewis acid properties, oxides, nitrides, aqueous chemistry, hydrides, organometallic AlR_3 compounds, synthesis, structure, and bonding.
Chapter 13

Group IV-Carbon, graphite, diamond and buckyballs, C-atom compounds, halides, simple C-N compounds.
Chapter 14

Phosphorus-allotropes, reactions of elemental P, oxides, oxyacids, P/S systems, P-N chemistry (phosphazenes).
Chapter 15

Ligand chemistry/Special topics-these will be discussed if time permits in the order listed above.