SYLLABUS

Inorganic Chemistry I

The University of Toledo
Department of Chemistry and Biochemistry
Collage of Natural Sciences and Mathematics
CHEM 3610, CRN 11179, Section 001
CHEM 3610 Honors, CRN 11181, Section 091

Instructor: Dr. Michal Marszewski
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Office Hours: MTWRF 9:30–10:30 am
Office Location: WO 2256
Instructor Phone: (419) 530-1585

Offered: Spring 2022
Course Website: Blackboard Learn
Class Location: BO 1045
Class Day/Time: MWF 8:30–9:25 am
Credit Hours: 3

SPECIAL COURSE EXPECTATIONS DURING COVID-19

Maintaining a safe campus during the ongoing COVID-19 pandemic remains a top priority. UToledo continues to follow the guidance of the U.S. Centers for Disease Control and Prevention and Ohio Department of Health to keep our campus safe.

ATTENDANCE

The University of Toledo has a missed class policy. It is important that students and instructors discuss attendance requirements for the course. Before coming to campus each day, students should take their temperature and complete a self-assessment for symptoms of COVID-19, such as cough, chills, fatigue or shortness of breath. Anyone with a temperature at or above 100.0 degrees Fahrenheit or who is experiencing symptoms consistent with COVID-19 should not come to campus and should contact their primary care physician or the Main Campus Health Center at 419.530.3451 or Health Science Campus Student Health and Wellness Center at 419.383.5000. For more information on the symptoms of COVID-19, please go to https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html

COVID-19 testing for sick students is available on both Main Campus and Health Science Campus. Call 419.383.4545 for an appointment. Absences due to COVID-19 quarantine or isolation requirements **are** considered excused absences. Students should notify their instructors and follow the protocols summarized in this document on Navigating COVID-Related Course Concerns.

In the event that you have tested positive for COVID-19 or have been diagnosed as a probable case, please review the CDC guidance on self-isolation and symptom monitoring, and report the disclosure to the Division of Student Affairs by emailing StudentAffairs@utoledo.edu or by connecting with their on-call representative at 419.343.9946. Disclosure is voluntary and will only be shared on a need to know basis with staff such as in the Office of Student Advocacy and Support, The Office of Residence Life, and/or the Office of Accessibility and Disability Resources to coordinate supportive measures and meet contact tracing requirements.

FACE COVERINGS

Face coverings are required while on campus, except while eating, alone in an enclosed space, or outdoors practicing social distancing. Students will not be permitted in class without a face covering. If you have a medical reason preventing you from wearing a face covering due to a health condition deemed high-risk by the CDC, submit an online application to request an accommodation through the Office of Accessibility and Disability Resources. Students will need to provide documentation that verifies their health condition or disability and supports the need for accommodations. Students already affiliated with the Office of Accessibility and Disability Resources who would like to request additional accommodations due to the impact of COVID-19, should contact their accessibility specialist to discuss their specific needs. You may connect with the office by calling 419.530.4981 or sending an email to StudentDisability@utoledo.edu.

VACCINATION

Doctors and other health care professionals agree that the best way to protect ourselves and each other is to get vaccinated. Case data clearly show that vaccines remain highly effective at preventing serious illness from COVID, including the highly contagious delta variant. If you have not yet received your COVID vaccine, the University encourages you do so as soon as possible. No appointment is needed to get the shot at the UTMC Outpatient Pharmacy, University Health Clinic or Main Campus Pharmacy. Once you receive the COVID vaccination, please register on the COVID Vaccine Registry site at: https://utvaccinereg.utoledo.edu/.

SPECIAL NOTES

It's important to note, that based on the unpredictability of the COVID-19 virus, things can change at any time. So please be patient and understanding as we move through the semester. Please refer to https://www.utoledo.edu/coronavirus/ on a regular basis for updates to current requirements or mandates. I also ask that you keep me informed of concerns you may have about class, completing course work/assignments timely and/or health concerns related to COVID.

CATALOG/COURSE DESCRIPTION

The application of modern theories to the elements and their inorganic compounds. Physical chemical principles are used throughout.

COURSE OVERVIEW

Inorganic chemistry spans all known elements and all phases of materials. It is applicable to a broad range of topics, including petroleum refining, pharmaceutical production, photovoltaics, polymers, semiconductors, nanomaterials, biochemistry, and catalysis. This course will introduce fundamental principles and concepts of inorganic chemistry, and should be pertinent for students studying chemistry, biochemistry, medicinal chemistry, materials chemistry, physics, chemical engineering, and pharmacy.

TEACHING METHODOLOGY

The course will be conducted in the traditional lecture style using blackboard and PowerPoint slides. The textbook (see Required Instructional Materials) is the primary source of material while lectures are designed to clarify and help understand the material covered in the book and to provide

examples of what is expected of students in this course. It is strongly recommended that students read the appropriate chapter in the textbook before each lecture.

STUDENT LEARNING OUTCOMES

By successfully completing this course, students will be able to:

1. Explain structures and bonding in inorganic and organometallic compounds and complexes.
2. Identify molecular symmetry and assign molecules to point groups.
3. Predict and identify the metal oxidation state, number of *d* electrons, spin state (high-spin or low-spin), and number of unpaired electrons in *d*-metal ions and complexes.
4. Explain ligand field and crystal field theories and identify Jahn-Teller distortions in *d*-metal complexes.
5. Classify ligands as strong-field, weak-field, π-donors, π-acceptors, and/or σ-donors.
6. Explain the chelate effect and its importance.
7. Identify common reactions in *d*-metal organometallic complexes.

PREREQUISITES AND COREQUISITES

CHEM 2420 Organic Chemistry II with a minimum grade of C- **or**
CHEE 2230 Chemical Engineering Thermodynamics I and CHEE 2330 Chemical Engineering Thermodynamics II both with minimum grade of C-

TEXTS AND ANCILLARY MATERIALS

Required textbook: Inorganic Chemistry (5th Edition) by C. E. Housecroft and A. G. Sharpe. Published by Pearson, ISBN eBook: 978-1-292-13416-1; ISBN print text: 978-1-292-13414-7

TECHNOLOGY REQUIREMENTS

A computer with a modern browser and internet access is required to access Blackboard Learn, lecture recordings, and other online course materials. Accessing lecture recordings online may be necessary in the event that either you or the instructor cannot participate in the class in person (see the Attendance section above). For more information about accessing Blackboard Learn and other useful resources provided through UToledo Online please visit: https://www.utoledo.edu/dl/students/required-info-online-learners.html.

A non-programmable, non-graphical scientific calculator will be necessary for problem solving in class and during exams.

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ACADEMIC POLICIES

All students at the University of Toledo are expected to read, understand, and follow the academic policies that govern their attendance at the University. These policies include, but are not limited to, academic dishonesty, academic forgiveness, adding and dropping a course, grades and grading, and

the missed class policy. Please use the following URL to read a comprehensive list of academic policies that pertain to you in this class and throughout your academic journey.
Undergraduate Policies: http://www.utoledo.edu/policies/academic/undergraduate/
Graduate Policies: http://www.utoledo.edu/policies/academic/graduate/

COURSE EXPECTATIONS

Lecture attendance is expected (subject to the guidelines provided in the Attendance section above) and you are responsible for all material and problems covered in class, as well as all assigned readings, practice problems, etc.

Lectures will be recorded and made available online for students who cannot attend due to COVID-19 quarantine or isolation. Note that while these absences are considered excused, students are NOT exempt from the material covered and/or assigned in class during their absence.

The textbook (see Required Instructional Material) is the primary source of material during the course. Lectures are designed to clarify and help understand the material covered in the textbook and to provide examples of what is expected of students in this course. It is strongly recommended that students read the appropriate chapter in the textbook before each lecture.

Please be considerate of your fellow students during the lecture period. Disruptions of any kind will not be tolerated and may result in expulsion from the classroom, this includes late arrivals, use of electronics, and chatting. Eating, drinking, and electronic smoking is prohibited in class.

You should consult the course website via the Blackboard Learn for course news and announcements.

OVERVIEW OF COURSE GRADE ASSIGNMENTS

Formal homework (10 points each) will be assigned multiple times throughout the course (at least once per chapter, approximately 10-12 times). These will be collected and graded and contribute to your final score in the course. Homework assignments must be submitted by the indicated due date to receive credit. One late homework assignment during the semester will be accepted for grading provided it is not late more than 5 days. Homework not submitted by the due date will result in score of 0 for that assignment.

Suggested problems may also be recommended during the class to help you prepare for the exams but will not be collected or graded.

There will be two midterm exams (100 points each) and the final comprehensive exam (150 points). Missing an exam will result in a score of zero (0) for that exam. A makeup exam can be taken at a later date if all of the following conditions are true: (1) the exam was missed due to unforeseen and irresolvable circumstances, (2) the instructor was timely informed of the absence and of the reason, generally no later than 24 hours after the exam, (3) written documentation from a third party was timely provided to support the absence, e.g., a physician's note, an accident report, a pastor's note, etc., and (4) the makeup exam can be taken in a timely fashion, generally within a few days after the original exam. All requests for makeup exams are considered on a case by case basis. Examples of unforeseen and irresolvable circumstances include illness, car accident, death in the family, etc.

Absences due to personal reasons, such as oversleeping, transportation problems, vacation plans, work schedule conflicts, dentist appointments, etc. do not qualify as unforeseen and irresolvable.

Honors students will complete an independent research project on a topic in inorganic chemistry (100 points). A minimum grade of B on the project will be required to earn Honor's Credit. The details are provided in the Honors Assignment section below.

Midterm Grading

Midterm grades are used to assist students with determining their academic standing. Attendance is also recorded to meet state and federal laws regarding financial aid disbursement. Please note, if you are not attending class it could affect your financial aid (scholarships, grants, loans or Federal Work Study). If you decide you are not going to attend this class (or any other class you have registered for), you should formally withdraw (drop) from the course. You can do this by logging on to the myUT portal, clicking on the "Student" tab, and then under "MyToolkit" click on Register/Drop/Withdraw.

Your midterm score will be the sum of all points earned from the formal homework assignments and exams completed before midterm grades are due. Your midterm score will then be converted to a percentage based on all points available to earn during this time period and then converted to a letter grade based on the grading scale provided below.

Final Grading

Your final score in this course will be the sum of all points earned from the formal homework assignments and exams (and the research project in the case of honors students). Your final score will then be converted to a percentage based on all points available to earn during the semester and then converted to a letter grade based on the grading scale provided below.

Grading Scale

A	≥ 90%	C	≥ 70%
A-	≥ 86%	C-	≥ 66%
B+	≥ 83%	D+	≥ 63%
B	≥ 80%	D	≥ 60%
B-	≥ 76%	D-	≥ 57%
C+	≥ 73%	F	< 57%

HONORS ASSIGNMENT

Honors students will independently research a topic in inorganic chemistry, prepare a one-page abstract and a paper on the subject, and have an interview with the instructor to answer questions about their paper and topic. The abstract should be single-spaced, with 1" margins, and in Times or Times New Roman size 12 font. The final paper should use the same font and margins but be double-spaced. The paper should be 5-6 pages long (figures, tables, and references do not count towards the page count). The paper must include a minimum of 10 key references cited in the text. References must be listed using standard ACS format as found in the ACS Style Guide and in the January 2022 issue of the Journal of the American Chemical Society. In the paper, students must define the topic, provide pertinent background and examples, and explain the relevance to society. Details to present may include synthetic schemes, bonding descriptions, mechanistic details, and

commercial significance. The student must be prepared to answer questions from the instructor of the course during an interview at the semester's end.

Topics could include, but are not limited to, the following:

Fischer-Tropsch Process	Shell Higher Olefins Process
C–H Bond Activation	Nitrogenase
Chemical Vapor Deposition	Methane Reforming
Hydroformylation	Zeolites
Hydrogenases	Wades Rules and Boron Hydrides
Phosphazenes	Metal-Metal Triple, Quadruple, and Quintuple Bonds
Borazines	DuPont Adiponitrile Process
Nanoparticles	Methylaluminoxane
Oxygenases	Multiple Bonding of Heavier p-Block Elements

Other topics can be chosen but must be preapproved by the instructor and each topic is limited to one student.

Topic choice due: February 6

Abstract due: March 13

Paper due: April 17

Interview: April 21-April 29

The honors project is worth 100 points, and a minimum grade of B is required to earn Honor's Credit. The topic, abstract, and paper submitted after their respective due dates will result in 4-point deduction per day. Projects that incur more than 20-point deduction will not be accepted and will result in score of 0 for the honors assignment.

UNIVERSITY POLICIES

Your safety and well-being as a University of Toledo student is important to the faculty, staff, and administration; as such please take a minute to review the following university policies that apply to you as a student of the University: https://www.utoledo.edu/title-ix/policies.html. Please use this URL to view a more comprehensive list of student policies: https://www.utoledo.edu/policies/audience.html/#students

Institutional Classroom Attendance Policy: Please be aware that the university has implemented an attendance policy, which requires faculty to verify student participation in every class a student is registered at the start of each new semester/course. For this course, if you have not attended/participated in class (completed any course activities or assignments) within the first 14 days, I am required by federal law to report you as not attended. Unfortunately, not attending/participating in class impacts your eligibility to receive financial aid, so it is VERY important that you attend class and complete course work in these first two weeks. Please contact me as soon as possible to discuss options and/or possible accommodations if you have any difficulty completing assignments within the first two weeks.

Policy Statement on Non-Discrimination on the Basis of Disability (ADA): The University is an equal opportunity educational institution. Please read The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance. Students can find this policy along with other university policies listed by audience on the University Policy webpage (http://www.utoledo.edu/policies/audience.html/#students).

Academic Accommodations: The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an Accommodations Memo from the Office of Accessibility and Disability Resources, I invite you to correspond with me as soon as possible so that we can communicate confidentially about implementing accommodations in this course.

For students who have not established accommodations with the Office of Accessibility and Disability Resources and are experiencing disability access barriers or are interested in a referral to health care resources for a potential disability, please connect with the office by calling 419.530.4981 or sending an email to StudentDisability@utoledo.edu.

ACADEMIC AND SUPPORT SERVICES

Please follow this link to view a comprehensive list of Student Academic and Support Services (http://www.utoledo.edu/studentaffairs/departments.html) available to you as a student.

SAFETY AND HEALTH SERVICES FOR UT STUDENTS

Please use the following link to view a comprehensive list of Campus Health and Safety Services available to you as a student and click here for information on the Office of Public Safety.

INCLUSIVE CLASSROOM STATEMENT

In this class, we will work together to develop a learning community that is inclusive and respectful. Our diversity may be reflected by differences in race, culture, age, religion, sexual orientation, gender identity/expression, socioeconomic background, and a myriad of other social identities and life experiences. We will encourage and appreciate expressions of different ideas, opinions, and beliefs so that conversations and interactions that could potentially be divisive turn, instead, into opportunities for intellectual and personal development.

COURSE SCHEDULE (NEXT PAGE)

COURSE SCHEDULE

The following book chapters will be covered in the order listed in the below course schedule. The weeks and dates indicated in the schedule are **only an estimate** and are subject to change due to many factors, including weather, class cancelations, and the course's effective pacing.

WEEK	WEEK OF	TOPIC(S)	COMMENTS
1	01/17	Syllabus overview Basic Concepts: Atoms (Chapter 1)	No class Monday (01/17)
2	01/24	Basic Concepts: Atoms (Chapter 1) Basic Concepts: Molecules (Chapter 2)	
3	01/31	Basic Concepts: Molecules (Chapter 2) Introduction to Molecular Symmetry (Chapter 3)	
4	02/07	Introduction to Molecular Symmetry (Chapter 3)	
5	02/14	Bonding in Polyatomic Molecules (Chapter 5)	
6	02/21	Bonding in Polyatomic Molecules (Chapter 5) **Midterm exam**	
7	02/28	Acids, Bases, and Ions in Aqueous Solution (Chapter 7)	
8	03/07		Spring break
9	03/14	Acids, Bases, and Ions in Aqueous Solution (Chapter 7)	
10	03/21	*d*-Block Metal Chemistry: General Considerations (Chapter 19)	
11	03/28	*d*-Block Metal Chemistry: General Considerations (Chapter 19) *d*-Block Metal Chemistry: Coordination Complexes (Chapter 20)	
12	04/04	*d*-Block Metal Chemistry: Coordination Complexes (Chapter 20) **Midterm exam**	
13	04/11	Organometallic Compounds of *s*- and *p*-Block Elements (Chapter 23)	
14	04/18	Organometallic Compounds of *s*- and *p*-Block Elements (Chapter 23) Organometallic Compounds of *d*-Block Elements (Chapter 24)	
15	04/25	Organometallic Compounds of *d*-Block Elements (Chapter 24)*	
16	05/02	**Final exam (Monday, 05/02/2022) 8:00–10:00am**	

*Time permitting and depending on the makeup of the enrolled students, a selection of the following topics may also be covered after completion of the core material listed above:

- Non-aqueous Media (Chapter 9)
- Catalysis and Some Industrial Processes (Chapter 25)
- *d*-Block Metal Complexes: Reaction Mechanisms (Chapter 26)
- Inorganic Materials and Nanotechnology (Chapter 28)