

Advanced Inorganic Chemistry I

CHM 320 (4 credits)

Fall 2022, Kutztown University

Instructor: Dr. Darren Achey

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Course Meeting Hours

Lecture: Monday, Wednesday, Friday, 10:00 – 10:50 PM, Boehm Hall, Room 260

Lab: Thursday, 8:00 – 10:50 AM, Boehm Hall, Room 310

Office Hours: Tues. 10 - 11 AM and 2 - 3PM, Wed. 1 - 3 PM, Fri. 1 - 2 PM and by appointment in Boehm 423.

Course Description

Inorganic chemistry is an extremely broad and varied field and this course will highlight the foundations necessary to understand a wide range of special topics. The application of physio-chemical principles to understanding structure and reactivity in main group and transition elements. Valence Bond, Crystal Field, VSEPR, and LCAO-MO will be applied to describe the bonding in coordination compounds. Organometallic and bio-inorganic chemistry will also be treated. The laboratory will involve both synthetic and analytic techniques and interpretation of results.

Prerequisites

CHM 100, CHM 102, CHM 214, CHM 216 and CHM 230

Reading Materials

Textbook: [CHM 320 Advanced Inorganic Chemistry Libretext textbook](#)

Additional texts: *Inorganic Chemistry, 6th edition*, Shriver, D.F. & Atkins, P.W. (ISBN: 1-4292-9906-1), W.H. Freeman and Co. (2014).

Inorganic Chemistry, 4th edition, Housecroft, C.E. & Sharpe, A.G. (978-0-273-74275-3) Pearson (2012)

Miessler, G.L.; Tarr, D.A. *Inorganic Chemistry*, 5th edition, Prentice Hall, 2013.

Course Objectives

- Describe periodic properties of the elements as well as atomic and molecular orbitals
- Determine and utilize both Bronsted-Lowry and Lewis Acids and Bases and their reactions
- Describe the coordination chemistry of the transitional metal elements in terms of Crystal Field and Molecular Orbital theories
- Describe the electronic properties and reactivity of transition metal complexes
- Articulate reaction mechanisms for transition metal complexes and catalysts
- Describe how Inorganic Chemistry is interrelated with Biochemistry
- Determine symmetrical features and point groups for molecules
- Understand the formation and structures of solids in terms of atomic layout as well as energetics and band theory
- Research/summarize relevant literature and present it cohesively and succinctly

Course Evaluation

Assessments	Percent of Total Grade
Participation/Intro Questions/Homework Sets	15 %
Laboratory – Reports and Notebook	20 %
Literature Discussions	10 %
Midterm Exams – 3 x 10 %	30 %
ACS Inorganic Final	10 %
Final Exam	15 %

Participation: As many lectures will involve extensive discussion on the assigned readings, attendance and participation are a major part of the overall grade. As such, the expectations include taking part in

the class discussions on a regular basis. Additionally, beginning of class questions answered by the student will be used to review key concepts from previous lectures. Unexcused absences will be considered as lacking in participation, as each and every person is a key part of the learning experience.

Homework Sets: Homework sets will be due throughout the semester. Working with classmates on the homework sets is highly encouraged, but each person should understand how to answer each question.

Laboratory: See D2L website for handouts and rubrics for laboratory reports. In addition, the lab notebook will be graded. **The lab reports are unique for each lab partner.**

Literature Discussion: Each student will be responsible for reading a literature article and answering some questions regarding the article prior to the class discussion. Each student will take part in the discussion of the literature article to a substantial degree.

Midterm Exam and Final Exam: All exams will be cumulative and will involve problem solving as well as multiple choice questions aimed at interrogating general understanding.

ACS Inorganic Exam – As a component of your final grade, the ACS Inorganic Exam will be given.

Grade Assignments

A = 94 % or greater

A⁻ = 90-93 %

B⁺ = 87-89 %

B = 83-86 %

B⁻ = 80-82 %

C⁺ = 77-79 %

C = 70-76 %

D = 60-69 %

F = 59 % or lower

Late Grading Policy

Work handed in past the due date will lose 10 % for each day late.

Academic Honesty Policy

Academic integrity is of the utmost importance in this course and university as a whole. You are expected to be working individually for exams and quizzes, and are permitted and encouraged to work in teams for homework sets and group presentations. The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Report any violations you witness to the instructors.

Read the official Kutztown University Policy on academic honesty (web link below).

[Kutztown University Honesty Policy.](#)

Classroom Accommodations for Students with Disabilities

If you have already disclosed a disability to the Disability Services Office (Stratton Administration Building 215) and are seeking accommodations, please speak with me privately so that I may assist you. If you have an injury sustained during military service including PTSD or TBI, you are also eligible for accommodations under the ADA and should contact the Disability Services Office.

Statement of Diversity and Inclusion

Kutztown University is a community committed to sharing values of diversity and inclusion in order to achieve and sustain excellence. We believe excellence is best promoted by being a diverse group of students, faculty and staff who are committed to creating a climate of mutual respect that is supportive of one another's success. Through its curricula and clinical experiences, we purposefully support the University's goal of diversity, and in particular, work toward an ultimate outcome of best serving the needs of students.

Reporting of Gender-Based Crimes

In order to comply with Title IX of the Education Amendments of 1972 and university policy, Kutztown University's faculty and staff must report incidents of sexual violence, sexual harassment, dating violence, domestic violence, and stalking, including relevant details, such as the names of those involved in the incident, to the Department of Public Safety and Police Services and to Jesus Peña, Title IX Coordinator. The only exceptions to the faculty member's reporting obligation are when the previously listed offenses are communicated by a student during a classroom discussion, in a writing or other creative assignment for class or as part of a university-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person/entity designated in the university's protection of minors policy. Information regarding the reporting of sexual violence and resources available to victims of sexual violence is set forth at:

https://apps.kutztown.edu/SZ_001_POLICY_REGISTER/Policy/DIV-007

<https://www.kutztown.edu/Departments-Offices/A-F/DeanStudents/Documents/DIV-008.pdf>

Class schedule (*subject to change*)

Week #	Week of:	Topics	Chapter(s)
1	8/29	Atomic Structure	1,2
2	9/5	Molecular Structure	3
3	9/12	Chemical Bonding	4
4	9/19	Structure of Coord. Compounds	5
5	9/26	Symmetry	6
6	10/3	Symmetry	6
7	10/10	Electronic Structure I – Crystal Field	7
8	10/17	Electronic Structure II – Ligand Field	8
9	10/24	Coord. Compounds - Spectroscopy	9
10	10/31	Coord. Compounds - Thermodynamics	10
11	11/7	Coord. Compounds - Kinetics	11
12	11/14	Catalysis	11
13	11/21	Thanksgiving Break	
14	11/28	Solid State Chemistry	12
15	12/5	Solid State Chemistry	12
Final		Mon. December 12, 8 AM	

Hour long midterm Exam Dates:

Wednesday, September 28

Wednesday Oct. 26

Wednesday, November 30

Final Exam Date: Monday, December 12, 8 AM-10AM

Lab schedule (subject to change)**

Week #	Date	Topics	Assignments Due
1	9/1	Lab Intro/Safety/Notebook/Crystal Lab/Lit Discuss	
2	9/8	MOF synthesis and characterization	
3	9/15	Metal (acac) synthesis	MOF report
4	9/22	Metal (acac) 2/Lit Discussion	Postlab summary
5	9/29	Mixed Metal Oxide 1	
6	10/6	Mixed Metal Oxide 2	Metal (acac) Report
7	10/13	Mixed Metal Oxide 3/SEM	
8	10/20	Literature Discussion	Mixed Metal Report
9	10/27	Cobalt project 1	
10	11/3	Cobalt project 2	
11	11/10	Cobalt project 3	Postlab Summary
12	11/17	Literature Discussion	
13	11/24	Thanksgiving	
14	12/1	Scanning Electron Microscope/XRF?	Cobalt Report
15	12/8	ACS Inorganic Exam	