Chemistry 302 W23

Instructor: Dr. Joshua A. Buss, jbuss@umich.edu

GSI: Mr. Matthew Peris, mperis@umich.edu
UIA: Ms. Kara Greene, grkara@umich.edu

Class: M, W, F 9:00 – 9:50 a.m. 1200 CHEM

Discussion: T 9:00 – 10:00 a.m. 1636 CHEM & W 1:00 – 2:00 p.m. 1632 CHEM

Office Hours: M 2:00 – 3:30 p.m. & Th 3:00 – 4:00 p.m. 4811 CHEM (Location subject to change)

Credits: 3

Course Prerequisites: Chem 130 (or equivalent) *required*; 210, 215, and 230/260 *recommended*

Course Description
Chemistry 302 is an introduction to the principles of inorganic chemistry. We will first explore atomic structure and theories of chemical bonding. Then, we will apply these bonding descriptions toward understanding chemical reactivity and physical properties.

Required Text:
Inorganic Chemistry Gary L. Miessler, Paul J. Fischer, and Donald A. Tarr, 5th. Ed. Pearson
ISBN-13: 978-0-321-81105-9

Course Requirements

1. Problem Sets—Wrestling with problems in inorganic chemistry is the best way to master the course material. Therefore, problem sets will be assigned regularly throughout the term (approximately every other week). *Students are strongly encouraged to work together on these exercises*. These problems will not be graded, but solutions will be posted. The types of questions seen on problem sets are designed to be representative of the more challenging quiz and exam content. Spending time working these sets will help prepare you for assessments that will affect your final grade.
2. Quizzes—As a feedback mechanism for content mastery, timed quizzes will be administered through Canvas regularly throughout the term (approximately every other week; staggered with the problem sets). Quizzes will include a short answer section (matching, multiple choice, etc.) in addition to more in-depth worked problems. **The ability to scan (or photograph) answers and upload them to Canvas is required.** These assessments will be timed and graded and must be completed individually to demonstrate each students understanding of content.
3. There will be three examinations administered in the course. The midterm exams will be administered during the scheduled lecture time on February 10th and March 24th. The final exam will be held on April 21st from 1:30 to 3:30 p.m. All required materials will be provided as part of the exam—only a writing instrument and calculator are allowed.

Note: Students who need special accommodations or who have conflicts with quizzes and exams due to religious holidays or travel (including virtual meetings) for U-M athletics or professional development, should e-mail the instructor at least two weeks in advance to make alternate arrangements. For short term illnesses, please e-mail the instructor as soon as possible. In most cases, the instructor will find an alternate time to complete quizzes or to input exam responses.

Grading Details

To be clear: grades are not given in CHEM 302, they are earned. Each student's final grade will reflect their understanding, effort, and output in the course.

Grading in CHEM 302 will be broken down as follows:

- 30% Quizzes (administered via Canvas)
- 40% Midterm Exams (20% each)
- 30% Final Exam

Quiz & exam questions may take on any style: short answer, multiple choice, true/false, matching, calculations, providing drawings, etc. The instructor, GSI, & UIA **will not** consider minor grade-haggling requests (1 – 2 points). However, students may return quizzes/exams having *significant* grading errors (≥ 3 points in grading a single question) for reconsideration within one week of getting them back. Students must not alter their work in any way. Rather, students should submit no more than one separate page by e-mail stating the grading errors clearly and concisely to the instructor (exams) or GSI (quizzes). This statement must show that: 1) the answer key is incorrect or incomplete; 2) the answer provided is an equally valid solution; or 3) the answer provided matches that given in the key, but was not recognized as such. Note that correct answers buried within superfluous information and/or outright incorrect reasoning may be graded as wholly incorrect. Any changes in scoring will only occur through this formal process to assure grading integrity.

The class will be graded on a curve. Grades of D or lower are extremely rare, and usually result from a severe lack of serious effort from the student (e.g. not attending class or discussion, not trying the practice problems, etc.). The decision to raise grades for students near the grade cutoffs set at the end of the term is at the sole discretion of the instructor, and is based on participation (attendance at lecture, discussion, and office hours), consistent effort in attempting the practice problems, and trends in improvement.

***Note**: Departmental policy indicates the first step in inquiring about the accuracy of a final grade should be directed to the lead instructor of the course. This initial inquiry should take place within the first fifteen University business days of the first full term following the term in which the disputed grade was issued. If, after this inquiry, the student is not satisfied with the instructor's response, the student may choose to initiate a formal grade grievance. To initiate a formal grade grievance, the student should contact the Associate Chair of Undergraduate Studies (ACUS) of the home department of the course in question before the end of the fifth week of classes in the first full term following the term in which the disputed grade was issued.*

Academic Integrity

There is a clear expectation that students will perform with honor and integrity. Students are referred to the LSA policy on academic integrity available online at:

https://lsa.umich.edu/lsa/academics/academic-integrity.html

Any student found by the Assistant Dean's office to have engaged in academic misconduct on quizzes or exams will automatically fail the course.

Course Expectations and Organization

Students in CHEM 302 are expected to take advantage of all the learning tools available to them to empower their success in the course. A key aim of the class is to develop independent thought rooted in the scientific method such that chemical examples flow directly from first principles. Quizzes and exams are designed to demand an extension of covered content, not a regurgitation of lecture material. Engaging in discussion sections, problem sets, and office hours are critical to succeeding in this process.

A tentative course schedule is provided below but is subject to change at the instructor's discretion. Each day's lecture content will be briefly summarized at the beginning of class as a means of contextualizing course progress. Associated reading assignments in the textbook will be communicated via this mechanism. Note that the instructor may use terminology and notation that differ slightly from that used in the text, and students are responsible for understanding our terminology. Students are *strongly encouraged*

to participate actively in lecture sessions, attend office hours, and ask lots of questions. Note that the instructor cannot provide recommendation letters for students who are not well known by the end of the term regardless of their final grade.

Other Important Course Logistics/Information:

- Lectures for this course will be recorded and made available *asynchronously* (posted to Canvas). Lecture notes will not be posted separately, but are available as part of the lecture recordings. Even so, in-person attendance is strongly recommended, health permitting; historically, lecture attendance correlates proportionately with success in this class.
- The instructor will make every effort to provide reasonable accommodation for unpredictable circumstances during this course, including but not limited to, loss of reliable Internet access/other technical difficulties. Accommodation will most likely take the form of granting short-term extensions on assignments or modifying the method of submitting your work, as is appropriate. Please reach out, as early as possible, as situations arise; clear communication will facilitate navigating challenges.
- While the University of Michigan plans for a full in-residence winter semester, we will remain flexible to accommodate new developments and adhere to the guidelines of the chemistry department, college of LSA, and UM at large. The instructor will endeavor to communicate changes to the course structure as early as possible to facilitate effective learning irrespective of the mode of delivery.

Statement on Student Well-Being

Students may experience stressors that can impact both their academic experience and their personal well-being. These may include academic pressure and challenges associated with relationships, mental health, alcohol or other drugs, identities, finances, etc.

If you are experiencing concerns, seeking help is a courageous thing to do for yourself and those who care about you. If the source of your stressors is academic, please contact me so that we can find solutions together. For personal concerns, U-M offers many resources, some of which are listed at Resources for Student Well-being on the Well-being for U-M Students website.

You can also search for additional resources on that website.

Date	Content
1/4/23	Lecture #1 – What is Inorganic Chemistry?
1/6/23	Lecture #2 – Early atomic structure hypotheses
1/9/23	Lecture #3 – Quantum numbers, radial probability functions, and atomic orbitals
1/11/23	Lecture #4 – Populating AOs in multi-electron atoms
1/13/23	Lecture #5 – Zeff, Slater's Rules, and periodic trends
1/16/23	MLK Day – No lecture
1/18/23	Lecture #6 – Electronegativity and atomic/ionic radii
1/20/23	Lecture #7 – Lewis structures and VSEPR theory
1/23/23	Lecture #8 – Valence bond theory
1/25/23	Lecture #9 – Hybridization and hybridization coefficients
1/27/23	Lecture #10 – 3c4e bonding
1/30/23	Lecture #11 – Molecular symmetry
2/1/23	Lecture #12 – Point groups
2/3/23	Lecture #13 – Applications of symmetry
2/6/23	Lecture #14 – Molecular orbital theory
2/8/23	Lecture #15 – MO theory as applied to diatomic molecules
2/10/23	Midterm Examination #1 – 1200 CHEM: 9 – 10am
2/13/23	Lecture #16 – Orbital mixing and energetic offsets in MO theory
2/15/23	Lecture #17 – Acid-base chemistry
2/17/23	Lecture #18 – pKa and properties influencing acidity/basicity
2/20/23	Lecture #19 – Charge density, level, and H-bonding
2/22/23	Lecture #20 – Lewis acid/base theory
2/24/23	Lecture #21 – Hard/soft acid/base theory
2/27/23	Vacation – No lecture
3/1/23	Vacation – No lecture
3/3/23	Vacation – No lecture
3/6/23	Lecture #22 – Introduction to solid-state chemistry
3/8/23	Lecture #23 – Unit cells and close packing
3/10/23	Lecture #24 – Lattice vacancies in ionic crystals
3/13/23	Lecture #25 – Lattice enthalpies and crystal defects
3/15/23	Lecture #26 – Band structure
3/17/23	Lecture #27 – Transition metal chemistry
3/20/23	Lecture #28 – Coordination geometries and isomerism
3/22/23	Lecture #29 – Crystal field theory
3/24/23	Midterm Examination #2 – 1200 CHEM: 9 – 10am
3/27/23	Lecture #30 – Ligand field theory
3/29/23	Lecture #31 – The spectrochemical series
3/31/23	Lecture #32 – Deriving d-orbital splitting diagrams by inspection
4/3/23	Lecture #33 – Term symbols
4/5/23	Lecture #34 – Tanabe Sugano diagrams
4/7/23	Lecture #35 – The Jahn Teller theorem
4/10/23	Lecture #36 – Electron counting in TM complexes
4/12/23	Lecture #37 – Ligand substitution reactions
4/14/23	Lecture #38 – Electron transfer and redox
4/17/23	Lecture #39 – Special Topics
4/21/23	Final Exam – 1200 CHEM: 1:30 – 3:30 PM