

Department of Chemistry
The University of Texas at El Paso
General Chemistry 1105
Persist Chemistry Laboratory

CHEM 1105

Fall Term, 2021

Instructor: Dino Villagrán, Ph. D.

CCSB 2.0402

Ext. 8750

Teaching assistant:

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T.A. Phone Number at Lab (915-747-7377)

COVID-19 Considerations

Laboratory will be held on Tuesdays from 12:00 pm to 2:50 PM in PSCI 302-304. For questions about the laboratory experiments talk to the T.A. Sheng Yin. His office hours will be Tuesdays from 4:00 –5:00 pm or by appointment.

COVID-19 PRECAUTION STATEMENT

Please stay home if you have been diagnosed with COVID-19 or are experiencing COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, so that we can work on appropriate accommodations. If you have tested positive for COVID-19, you are encouraged to report your results to covidaction@utep.edu, so that the Dean of Students Office can provide you with support and help with communication with your professors. The Student Health Center is equipped to provide COVID-19 testing.

The Center for Disease Control and Prevention recommends that people in areas of substantial or high COVID-19 transmission wear face masks when indoors in groups of people. The best way that Miners can take care of Miners is to get the vaccine. If you still need the vaccine, it is widely available in the El Paso area, and will be available at no charge on campus during the first week of classes. For more information about the current rates, testing, and vaccinations, please visit <http://epstrong.org>.

Course Description

The objective of this course is to present an alternative section to General Chemistry 1105. This course is designed to be a complementary course to General Chemistry 1305, however, it is designed in a different way that the standard 1105 laboratory is held. We will be performing actual novel and original research concerning the synthesis of nanomaterials towards water treatment. A variety of concepts of nanotechnology and molecular chemistry, including the study of highly porous materials called Metal-Organic Frameworks will be discussed. These materials are of current research interest in the current literature.

The following topics of interest to the first term of general chemistry, among others, will be covered:

- Mastering measurements and significant figures
- Use of chemical formulas and chemical drawings
- Acid Base chemistry
- Stoichiometry and balancing chemical reactions
- Understanding enthalpy measurements
- Structural and geometrical understanding of chemical compounds

Background on Nanotechnology and MOFs

Nanotechnology consists of the study of materials at the nanoscale, i.e., at the 10^{-9} m. This scale is slightly larger than the molecular scale (10^{-11} - 10^{-10} m) but much smaller than common chemical materials. Due to their very small size, nanomaterials have unique properties, such as huge surface areas which lead to increased abilities in adsorption, catalysis, and even in magnetism (when appropriate). We will learn and discuss some basic nanotechnology concepts, and their application towards water treatment.

Some materials, that have physical characteristics at the nanoscale are Metal-Organic Frameworks (MOFs). MOFs are formed by linking inorganic and organic units to build highly porous networks formed by strong bonds. This type of synthesis where extended networks are formed (as opposed to simple molecular complexes) is known as reticular synthesis. MOFs offer a wide variety of different porous geometries and porous sizes, which can be tailored to a large degree. This flexibility in obtaining different geometries has resulted in the synthesis of more than 20,000 different MOFs created in the last ten years.

The key advantage of MOFs is that they form highly porous structures. Through the formation of these porous structures, MOFs have an immense capacity to allow small molecules to be placed in the many interstices these materials have. This high-porosity physical property has been used to yield some versatile applications. Some MOFs have very small pores, and others have pores at the nanoscale.

One of the main applications of MOFs is the storing of gases. But more recently MOFs have been used as adsorbents to remove pollutants from water. MOFs have also been used as structural catalysts, where chemical reactions (sometimes the degradation of pollutants) occur within their pores. The stability of MOFs in water is something that must be investigated as well as their adsorption and catalytic properties. Thus, materials that could be used to clean water in an efficient manner are very welcome! In this lab, we will synthesize these supramolecular materials, characterize them, and study their physical properties.

Textbook:

No textbook will be required. Appropriate handouts will be provided as needed. All of these handouts will be uploaded to Blackboard which can be accessed through <http://my.utep.edu>.

Grading:

The grade for this course will consist on (1) your accurate and up to date research notebook; (2) the result of two presentations throughout the semester; (3) an initial and a final laboratory report at the end of the semester; and (4) your performance in the laboratory.

The grade distribution will be:

- 30% Quizzes
- 30% Research Presentations
- 15% Initial report on the project
- 15% End of semester research report
- 10% Performance in laboratory practice
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“Laboratory performance” includes attendance, successful execution of the experiment, and proper safety behavior.

Quizzes will be delivered through Blackboard and will have a time limit. These will focus on your understanding of the procedures in the lab.

Laboratory notebooks will be required whenever (or if) we meet in person. They will be subject to inspection **at all times**, and they will be graded throughout the semester. In these notebooks, the students shall write in

detail the experiments performed, results obtained, and any information pertinent to the research. Copies of each entry should be submitted to the T.A. for safekeeping.

5 to 10-minute research presentations at mid and at the end of the semester will be required. In these presentations the students will learn to present their work to a knowledgeable audience. These presentations will be held at the half point and end of the semester.

The initial report will consist in the students performing a literature search of current MOF work. A three-page report including an introduction, current work, a statement of research interest, and a references list (in a third page) will be assigned in the first weeks of the laboratory.

The final report shall include an introduction, a materials and equipment, experimental section, results, discussion, future work and conclusion section. You will need to submit a draft for feedback three weeks before you submit the final report.

Disability If you believe you may qualify for special accommodations due to disability contact the Center for Accommodations and Student Services Office: <http://sa.utep.edu/cass>; 915-747-5148.

Safety A separate safety instruction sheet will be provided. Students will be required to follow these laboratory rules at all times. Use of appropriate eyewear protection compliant to university rules is mandatory at all times during laboratory practice.

Course Drop Policy All grades of Incomplete must be accompanied by an Incomplete Contract that has been signed by the instructor of record, student, departmental chair, and the dean. Although UTEP will allow a maximum of one year to complete this contract, the College of Science requests it be limited to month based upon completion data. A grade of Incomplete is only used in extraordinary circumstances confined to a limited event such as a missed exam, project, or lab. If the student has missed a significant amount of work (e.g. multiple assignments or tasks), a grade of Incomplete is not appropriate or warranted. The deadline to drop this course with an automatic W is October 29th, 2021.

Other considerations: Please turn your cell phones off and keep them away during lectures and practices.