Physical Chemistry Laboratory II: Spring 2020
Chemistry 388

Instructor:

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Laboratory: T 12:30 – 3:15 p.m.; Jepson Science Center 409/411

Office Hours:

MWF 10:00 – 11:00 am
MW 1:00 – 2:00 pm
or by appointment

Required Course Materials:

Text: Engel, *Quantum Chemistry and Spectroscopy*, 3rd edition
Engel and Reid, *Thermodynamics, Statistical Thermodynamics & Kinetics*, 3rd edition
Hofmann, Angelika, *Scientific Writing and Communication*, 2nd edition
Coghill, Anne M. and Garson, Lorrin R., *ACS Style Guide*, 3rd edition
Dodd, Janet S., Ed. *ACS Style Guide*, 2nd edition (on-line portions)
CoursePack for CHEM 388

Calculator: with scientific notation and **logarithmic/exponential** functions

Course Description and Objectives:

This laboratory course will provide an understanding of the fundamental principles of chemical kinetics and quantum mechanics through experimentation utilizing techniques that may include spectroscopy, tunneling microscopy and computational chemistry. Spectroscopic techniques and principles, using modern equipment, will be emphasized. Problem-solving skills will be demonstrated in a guided-inquiry project. Communication, accuracy, and precision of scientific results will also be stressed in the form of scientific reports and oral presentation. After completing the course, the student should be able to

- interpret collected data in light of chemical kinetics and quantum mechanical theories
- use the chemical literature
- use developed or improved oral communication skills to demonstrate an understanding of chemical concepts related to a chosen topic.

In addition, as an SI course,

- Students will understand and be able to explain the conventions and expectations of oral communication as practiced within the discipline of the course taken.
- Students will apply theories and strategies for crafting messages (verbal, nonverbal, and visual) for particular audiences and purposes.
- Students will be able to craft oral messages after a conscious process in which various options are reviewed and will be able to explain and support their choices.
- Students will be able to metacommunicate about their own communication patterns.

Chemists are frequently employed in diverse fields including chemical industry, academia, environmental and scientific policy, patent law, consulting, etc. Employers look for demonstrations of team work, interpersonal skills, subject mastery, problem-solving and critical thinking abilities and both oral and written communication skills. This course is geared toward providing development and mastery of all of these crucial qualities.

Grading:

Laboratory Reports	60%
Oral Presentation	10%
Project Poster Presentation	10%
Pre-Laboratory Assignments	10%
Final Examination	10%

Students with a report, pre-lab and presentation average of C^- or less will receive a midsemester report.

Honor System:
All graded work (laboratory reports, pre-laboratory assignments and the final exam) must be your own and pledged: *I hereby declare upon my word of honor that I have neither given nor received any unauthorized help on this work.* *(Signed)*
Data will be collected in the laboratory with a partner; however, the laboratory notebook (which is the record of these data) and report will be your own.

Class Attendance:
Class attendance is **mandatory**. Failure to attend lab will result in a zero for the pre-lab assignment and lab report. Generally, each team will have 3 hours to collect the data for each experiment. For class meetings where time has been set aside for research (either library or experimental), time **must** be spent in these endeavors in the student computer room (Jepson 308) preparing the laboratory report or presentation, searching the literature or preparing for the next experiment/trial, or in the laboratory itself, *except* by explicit permission of the instructor.

Pre-Laboratory Assignments:
Pre-laboratory assignments are to be presented to the instructor **at the beginning** of the laboratory period. The pre-laboratory assignments are two-fold:

1. Students will individually work through the theory (background) for each experiment, posted on Canvas as a PowerPoint lecture and video (these are accessible on youtube), and answer the questions on the pre-lab assignment page (also on Canvas) on a separate piece of paper to be handed in. (In some cases there are also videos links demonstrating the experimental method; these videos that should be viewed as well.)
2. Students will also prepare the first page of their laboratory notebooks with proper identification, purpose and a three paragraph summary of the method to be followed for the experiment, having read through the detailed step-wise procedure in the coursepack, including a reference to where the entire procedure may be found using *proper citation format*.

Failure to submit either or both portions will result in a grade of zero for the entire laboratory experiment. (This includes both the pre-lab assignment and the lab report.) Any student who does not hand in a pre-laboratory assignment—answers to questions and completed notebook page-- will not be permitted to perform the experiment. These assignments must be completed individually; however, the use of your textbook and other reference materials to complete the work is allowed and encouraged.

Laboratory Reports:
All laboratory reports must be pledged as work performed individually. These laboratory reports will follow an abbreviated report form. Reports are due **one week after the completion of an experiment by the end of the laboratory period**. A late report will receive a grade of zero. **Each student is allowed a one week extension on **one** laboratory report (excluding the final report) provided that the student has submitted a written request for the extension. This should also be noted on the cover page for the report.

Reports will be graded on scientific content (although editorial comments (not grades) will be made on style, grammar, diction, etc.), the abstract and the scientific notebook. Scientific content includes accuracy and precision of results, adequate explanation of results, discussion of probable errors, well-formed conclusions based on data, and proper portrayal of results (tables and graphs). Appropriate referencing will be **stressed** in the laboratory report and failure to cite others' works will result in significant grade penalties. The scientific notebook will also play a very pronounced role in the grade as will the abstract.

Presentations:
In addition to the informal, in-class discussions on speaking and presentation styles in the sciences, there are two different types of formal presentations built into this course. The first is a 20-30 minute, oral presentation of the theory/concepts and background for an experiment you have found in the literature to incorporate into the Physical Chemistry Laboratory curriculum. The presentation is given as a team and must include the theoretical foundation behind the experiment (with research to extend beyond the original

paper), the method to be used, and what is hoped to be learned. In addition, it is expected that more background information is provided than in a written, brief laboratory report and that an effort is made to discuss your work in light of the current physical chemistry literature. Your grade will depend on the effort put forth by the team and by you individually (equal division of topics and time) and will include presentation stylistics such as level of the presentation (was the presentation aimed at junior and senior chemistry majors?), attention to the audience (did you make eye contact? did you speak at an appropriate pace and volume?), physical appearance and demeanor.

The second presentation is a poster presentation during Research and Creativity Day based on the guided-inquiry chemistry project you chose, again delving more closely into the background and your results (including briefly your chosen methodology) and how they fit into the context of the laboratory. The presentation will be attended to by members of the University community, including members of the chemistry department, your classmates, and faculty and students from all disciplines and departments. The presentation must be geared to the level of each person attending your poster. As with the formal oral presentation, you will be graded both on scientific content and on your communication skills. Each member of the group is expected to contribute equally to the presentation of the material. You will receive extra credit for going to the Speaking Center prior to your talks.

Disability Services: The Office of Disability Services has been designated by the University as the primary office to guide, counsel, and assist students with disabilities. You will need to request appropriate accommodations through this office as soon as possible and then make an appointment with me to discuss your approved accommodation needs. I will hold any information you share with me in the strictest confidence unless you give me permission otherwise.

Title IX: University of Mary Washington faculty are committed to supporting students and upholding the University's *Policy on Sexual and Gender Based Harassment and Other Forms of Interpersonal Violence.* Under Title IX and this Policy, discrimination based upon sex or gender is prohibited. If you experience an incident of sex or gender based discrimination, we encourage you to report it. ***While you may talk to me, understand that as a "Responsible Employee" of the University, I MUST report to UMW's Title IX Coordinator what you share***. If you wish to speak to someone confidentially, please contact the below confidential resources. They can connect you with support services and help you explore your options. You may also seek assistance from UMW's Title IX Coordinator. Please visit http://diversity.umw.edu/title-ix/ to view UMW's *Policy on Sexual and Gender Based Harassment and Other Forms of Interpersonal Violence* and to find further information on support and resources.

Class Recordings: Video and/or audio recording of class lectures and review sessions without the advance consent of the instructor is prohibited. On request, the instructor may grant permission for students to record course lectures, on the condition that these recordings are only used as a study aid by the individual making the recording. Unless explicit permission is obtained from the instructor, recordings of lectures and review

sessions may not be modified and must not be transferred or transmitted to any other person, whether or not that individual is enrolled in the course. Students with approved accommodations from the Office of Disability Resources permitting the recording class meetings must present the accommodation letter to the instructor in advance of any recording being done. On any days when classes will be recorded, the instructor will notify all students in advance. Distribution or sale of class recordings is prohibited without the written permission of the instructor and other students who are recorded. Distribution without permission is a violation of educational law. This policy is consistent with UMW's Policy on Recording Class and Distribution of Course Materials.

Topics and Experiments:

Speaking in the Sciences / Scientific Presentations
Rates of Chemical Reactions: Kinetic Salt Effect (2 weeks)
Application of the Particle in the box: Spectroscopy of a Conjugated Dye/Computational Chemistry; Gold Nanoparticles
Atomic Spectroscopy, Limitations of Bohr Theory and the Boltzmann Distribution: Atomic Emission Spectroscopy (ICP)
Phosphorescence Quenching of Terbium (III)
Scanning Tunneling Microscopy of Graphite
Physical Chemistry Research Project

A separate schedule of these experiments will be provided prior to the second laboratory period after student teams have been assigned.

Final Exam: Tuesday, April 28th; 12:00 – 2: 30 pm