

Chemistry 564

Objectives

- Understand the fundamentals of spectroscopic techniques
- Understand the basics of instrumentation in relation to making an experimental measurement
- Emulate, to some extent, the process by which new knowledge is generated
- Generate technical reports in a style that emulates scholarly publications
- Communicate scientific content in oral conversation
- Make connections between quantum mechanics and qualitative physical descriptions

Safety

Eye protection (goggles, or safety glasses that include side protection) and closed-toe shoes are always required in the laboratory whenever any experiments are in progress. Specific safety concerns are addressed in the individual experiment handouts.

Graded Materials

- *Online quizzes:* There are eight prelab quizzes worth 10 points each. These quizzes are due before the laboratory period on the assigned day. Your final score for each quiz is the highest score out of a maximum of three attempts.
- *Oral exams:* There are two oral exams worth 50 points each. You should be prepared to discuss the theory behind the experiment as well as specifics of your data and methods. Specific topics, details of the format, and the schedule will be discussed before each exam.
- *Presentation:* There is one presentation of written activities worth 50 points. Specific topics, details of the format, and the schedule will be discussed before the presentation.
- *Written report:* There is one formal written report worth 50 points. The report should be submitted to the dropbox on the course website. Files should be submitted in .pdf format. The penalty for late submissions is 4 pts/day.
- *Written activities:* Most laboratory periods have a set of written activities that are to be submitted at the end of the period. There are a total of eight sets of these activities worth 80 points combined.
- *Evaluation:* There is a 10 point evaluation score for most lab days (90 points total). This score is affected primarily by participation, lab hygiene, and timeliness.

Point Breakdown

Online quizzes (8)	= 80 pts
Oral exams (2)	= 100 pts
Written report (1)	= 50 pts
Presentation (1)	= 50 pts
Written assignments (8)	= 80 pts
Evaluation (9)	= 90 pts

Total = 450 pts

Using the grading scale for written reports and oral exams given on the next page, and assuming near perfect scores in the other categories, the final grades are intended to be assigned on the following scale:

<i>A</i>	>90%
<i>AB</i>	86-90%
<i>B</i>	80-86%
<i>BC</i>	76-80%
<i>C</i>	68-76%
<i>D</i>	58-68%
<i>F</i>	<58%

Grading Scale for Written reports and Oral Exams

- The overall strategy is to first assign an overall letter grade, then assign a score in the range based on the presence of minor flaws such as grammar and spelling mistakes, and lastly deduct points for late penalties or for improper presentation of data (e.g. plots with inappropriate formatting, tables that lack units or uncertainty estimates, etc). The grade categories, and corresponding points on a 50-point scale, should be viewed as:
 - *A*, 42-50: A letter grade of *A* means that the student: understands the concepts behind the experiment, understands the experimental implementation, understands the experimental variables, understands how to properly assign and propagate experimental uncertainty throughout the experiment, and has acquired data of reasonable quality (1-2 outliers, expected trends are present, etc).
 - *AB*, 38-42: A letter grade of *AB* means that the student demonstrates flaws in a few minor aspects of the above mentioned characteristics. Common situations include assigning uncertainty without proper justification, performing calculations without subsequent discussion in the text, excessive outliers in the data set, etc.
 - *B*, 32-38: A letter grade of *B* means that the student demonstrates a major flaw in understanding in one or two of the above mentioned characteristics. Common situations include improper assignment of uncertainty, mistakes in calculations, incorrect statements regarding the concepts behind the experiment, etc.
 - *BC*, 28-32: Compared to the previous case, a letter grade of *BC* means the student demonstrates multiple major flaws in scientific reasoning and the data analysis, but calculations are still expected to be mostly correct.
 - *C*, 20-28: The concept of a letter grade of *C* is that the student has, in a certain sense, simply followed directions and has completed what has been asked of them without scientific thought. The report must still be complete and calculations must be mostly correct. Essentially this means a report basically just presents the data, calculations, and results without a directly relevant, meaningful discussion (uncertainty may not be discussed at all, assigned improperly, etc.)
 - *D*, 10-20: A letter grade of *D* means that the report is inappropriate in some fashion, such as completely missing a section or missing calculations.
- *F*, 0-10: A letter grade of *F* means the student has failed the report. Compared to the previous case this means the report is simply missing multiple, necessary items. Written report and oral exam scores will be normalized across all graders at the end of the semester.

Guidelines for Academic Misconduct in the Physical Chemistry Laboratory

All writing presented in your formal reports must constitute your own intellectual property. Although you may certainly discuss ideas with other students, the presentation of those ideas must be your own individual work.

What *is* allowed:

- Work with other students for all experimental work
- Collaborate with other students for all data analysis work, including preparation of plots and tables
- Discuss ideas with other students regarding the interpretation of experimental results

What *is not* allowed:

- Write a report based off of someone else's work (another student, or a literature paper)
- Collaborate with other students on the written discussion of results, ideas, and concepts related to the experiment (i.e. write a group report)
- Submit a report with portions of text that are identical to the work of another person
- Submit a report where the presentation of ideas is identical to the work of another person (text only differs by superficial paraphrasing)

Cases of academic misconduct in the physical chemistry laboratory generally result in a score of 0 for the report for all individuals involved. A report of the incident is also filed with the Offices of the Dean of Students.

With this in mind, do not share electronic versions of your lab reports with other students. You are certainly welcome (and encouraged) to receive feedback from students and staff on rough drafts of your reports, but be protective of your intellectual property.

Schedule (★ = online individual submission, ⊕ = hard copy individual submission)

You will be assigned to either Group A or Group B at the start of the semester. Note that a complete list of activities to do before the start of each laboratory period is given in the *Preparation* subsection of each daily checklist in the handout for the experiment.

Week	Topic	Graded Activities
1/23	NMR (A) Microwave (B)	★ Take quiz (start of lab) ⊕ Submit activities (end of lab)
1/30	NMR (A) Microwave (B)	★ Take quiz (start of lab) ⊕ Submit activities (end of lab)
2/6	NMR (A) Microwave (B)	★ Take quiz (start of lab) ⊕ Submit activities (end of lab)
2/13	NMR (A) Microwave (B)	★ Take quiz (start of lab) ⊕ Submit activities (end of lab)
2/20	NMR (A) Microwave (B)	A: Presentation B: Postlab discussion
2/27	NMR (A) Microwave (B)	A: Oral exam B: Oral exam B: Written report (end of day)
3/6	Microwave (A) NMR (B)	★ Take quiz (start of lab) ⊕ Submit activities (end of lab)
3/13	Microwave (A) NMR (B)	★ Take quiz (start of lab) ⊕ Submit activities (end of lab)
3/20	<i>Spring Recess</i>	
3/27	Microwave (A) NMR (B)	★ Take quiz (start of lab) ⊕ Submit activities (end of lab)
4/3	Microwave (A) NMR (B)	★ Take quiz (start of lab) ⊕ Submit activities (end of lab)
4/10	Microwave (A) NMR (B)	A: Postlab discussion B: Presentation
4/17	Microwave (A) NMR (B)	A: Oral exam A: Written report (end of day) B: Oral exam

