PHYSICAL CHEMISTRY I LABORATORY

Fall 2025 C. Baumann
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Lab Text: "Experiments in Physical Chemistry", Garland, Nibler, and Shoemaker, Eighth Ed., McGraw-Hill, 2009.

The experiments for a given period will be assigned. Before each experiment, a spreadsheet for the experiment must be submitted to the instructor before the experiment may be started. A copy of all data must also be turned in at the end of the lab period.

The course grade will be a composite of report grades (80%) and laboratory technique. Attendance at all sessions is required. Failure to participate in the experimental procedure (due to unexcused absence or lack of an acceptable spreadsheet) will result in a grade of 'F' for that experiment. Laboratory reports for each experiment will be turned in the week after the experiment is completed. A penalty of one letter grade per week (or part thereof) will be assessed on late reports.

Date	Experiment	Reference
August 28	Introduction and Dummy Experiment	I-III
September 4	Introduction to LabView	XVI
September 11,18	Compressibility Factor Heat Capacity Ratio	notes 3
September 25, October 2	Cryoscopic Determination of Molecular Weight Heats of Ionic Reaction	10 8
October 9, 16	Partial Molar Volume Binary Liquid-Vapor Phase Diagram	9 14
October 23,30	Binary Solid-Liquid Phase Diagram Temperature Dependence of EMF	notes 18
November 6	Knudsen Effusion	V, notes
November 13, 20	Computational Chemistry	III, notes
December 4	Glass Blowing	XX

Format for Laboratory Reports

The laboratory report for an experiment in this course must minimally contain the following:

1. Introduction:

A brief statement of the purpose of the experiment and the theory behind the experimental procedure.

2. Experimental:

A description of the experimental procedure, referenced whenever possible to the textbook or accompanying materials. Deviations from the reference procedures should be noted in this section.

3. Results:

Data should be presented in tabular and/or graphical form in this section. Explanations of calculations, including sample calculations, should be included, as should statistical computations and sample spectra.

4. Discussion:

A brief analysis of the results of the experiment, sources of error (this is a numerical analysis, not an opportunity for a *mea culpa*) and suggestions for improvement of the procedure. Comparison of experimentally obtained quantities with referenced literature values should be made whenever possible.

5. References:

A list of all sources used in the laboratory report.

6. Appendix:

Computer output and spectra should be included in this section.

A rubric* for the evaluation of the laboratory report may be found at the end of this document.

The instructor will make numerous written comments on each graded lab report explaining how the written work and presentation either adheres to or deviates from that expected by ACS standards and the rubric below. Students are also encouraged to ask for more detailed explanations in person. Revision of work will be accomplished by incorporating changes into the next lab report.

Students with Disabilities

Students with Disabilities may be eligible for reasonable academic and non-academic accommodations. Students are required to submit relevant and current documentation of their disability. Students are encouraged to contact the Office of Student Support and Success at disabilityservices@scranton.edu or (570) 941-4038 if they have or think they may have a disability and wish to determine eligibility for any academic accommodations. For non-academic accommodations, students should contact the Office of Equity and Diversity at non-academic-accom@scranton.edu or (570) 941-6645. Students can access accommodate by clicking here.

Writing Center Services

The Writing Center is a resource designed to help students at all academic levels become better writers. It is a safe space where students from any discipline can receive one-on-one feedback on written assignments from well-trained peer consultants who support students in any stage of the writing process. Students can make an appointment through the my.scranton portal: my.scranton.edu >OSSS Card >Writing Center Scheduler. For more information, please contact writing-center@scranton.edu. For quick tips, user-friendly guides, and other writing resources, check out our blog at https://sites.scranton.edu/writingcenter.

Academic honesty:

The first time that a student is caught cheating on an exam or quiz, he or she will receive a grade of zero points for that assignment. For further consequences of violating academic ethics please refer to the University of Scranton Student Handbook.

https://www.scranton.edu/academics/cte/acad-integ/acad-code-honesty.shtml

My Reporting Obligations as a Required Reporter

As a faculty member, I am deeply invested in the well-being of each student I teach. I am here to assist you with your work in this course. Additionally, if you come to me with other non-course-related concerns, I will do my best to help. It is important for you to know that all faculty members are required to report incidents of sexual harassment or sexual misconduct involving students. This means that I cannot keep information about sexual harassment or discrimination, sexual assault, sexual exploitation, intimate partner violence or stalking confidential if you share that information with me. I will keep the information as private as I can but am required to bring it to the attention of the University's Title IX Coordinator, Elizabeth M. Garcia, or Deputy Title IX Coordinator, Diana M. Collins-Gilmore, who, in conversation with you, will explain available support, resources, and options. I will not report anything to anybody without first letting you know and discussing choices as to how to proceed. The University's Counseling Center (570-941-7620) is available to you as a confidential resource; counselors (in the counseling center) do not have an obligation to report to the Title IX Coordinator.

Non-Discrimination Statement

The University is committed to providing an educational, residential, and working environment that is free from harassment and discrimination. Members of the University community, applicants for employment or admissions, guests, and visitors have the right to be free from harassment or discrimination based on race, color, creed, religion, ancestry, gender, sex, pregnancy and related conditions, sexual orientation, gender identity or expression, sex characteristics, sex stereotypes, age, disability, genetic information, national origin, ethnicity, family responsibilities, marital status, veteran or military status, citizenship status, or any other status protected by applicable law..

Students who believe they have been subject to harassment or discrimination based on any of the above class of characteristics, or experience sexual harassment, sexual misconduct or gender discrimination should contact Elizabeth M. Garcia, Title IX Coordinator, (570) 941-6645 elizabeth.garcia2@scranton.edu, or Deputy Title IX Coordinators Diana M. Collins (570) 941-6645 diana.collins@scranton.edu,. The United States Department of Education's Office for Civil Rights (OCR) enforces Title IX. Information regarding OCR may be found at www.ed.gov/about/offices/list/ocr/index.html.

The SLO Track

In completing this course students should be able to:

1. manipulate a simple pressure/vacuum system safely
2. build a virtual instrument using LabView
3. use LabView to collect data from an experiment
4. prepare aqueous solutions safely and accurately with a minimum of waste
5. use specialized laboratory glassware appropriately and safely
6. use laboratory instrumentation appropriately, accurately and safely
7. use software to graph laboratory data appropriately
8. write concise laboratory reports that accurately explain the results of the experiments performed*
9. work safely and efficiently in a chemical laboratory
10. manipulate glass tubing and torches to produce functional glassware
11. build molecules using Gaussview and determine properties for these molecules using Gaussian

*Rubric for assessment of physical chemistry lab reports

General Description of Assessment Categories:

Proficient – Meets expectations of professional standards throughout.

Adequate – Meets expectations of professional standards in parts only. Contains specific items contrary to some expectations.

Learning – Meets few expectations of professional standards. Contains many items contrary to expectations.

Topic	Learning	Adequate	Proficient
Format			
	Meets many expectations but misses others. Or, has distinct aspects that make appearance unprofessional.	Contains one or more formatting errors. E.g. some items (e.g. page numbers, section headings, etc…) are omitted, in error, or not clear. Most aspects are present. Has many qualities of professional appearance.	All major sections are present; has pages setup correctly and numbered; figures, tables, equations and references are properly formatted; has professional appearance throughout.
Content			
Abstract	Contains at most one of the expected elements. Or, contains two of the expected elements but contains distracting information, errors, or is poorly written.	Accomplishes two of the three expectations for proficiency. Or, accomplishes all three expectations but contains distracting information, errors, or is poorly written.	States in clear manner: (1) purpose of experiment (2) methods used (3) major findings/conclusions. Is well-written, w/o errors, and properly formatted.
Introduction	Does not explain the purpose of the experiment or makes significant errors in understanding. Does not provide necessary information to understand what is presented.	States the purpose of the experiment without significant errors. Omits some information needed to understand the experiment or is not well-written (i.e. not well structured, or is unclear in parts).	Clearly states in well written fashion: what is being measured and how, importance of the information sought, and any conceptual information needed to understand the experiment. Briefly describes how report is organized. Introduction section must be concise, e.g. 1-2 paragraphs.

Experimental	Gives few experimental details or contains significant errors.	Omits some important experimental conditions but provides other necessary information.	Provides a description of method or cites appropriate reference. Clearly states all relevant information needed to interpret results. (e.g. modifications to expt, experimental parameters, measured concentrations, T, etc…)
Reference list	Makes significant errors in formatting reference list or omits important references.	Contains some errors but lists all important references. Has professional appearance.	Contains all appropriate references and is properly formatted.
Results			
Data and analysis	Did not complete a significant part of the experiment. Or, there are major conceptual errors in interpreting or analyzing data. Or, data and results are not presented in a logical, clear, or complete manner.	Contains some errors in data collection or in interpretation of results. Completed all data collection but may not have reported all pertinent data. Analysis reported in a logical way that clearly addresses the most important aspects of the experiment.	Completed all data collection. All pertinent data is reported. Report presents results in a logical way that clearly addresses all aspects of the experiment. All necessary information needed to reproduce analysis is given in report.
Figures/tables	Data is not clearly identified or is presented in an ambiguous or confusing manner. Tables and figures are not appropriately labeled or formatted.	Data is presented clearly but not all ACS standards are followed. Data are distinguishable and trends discernable. But some tables or figures have nonprofessional appearance.	Tables and figures are formatted according to ACS standards and present data clearly and unambiguously. All data is clearly labeled and units are specified. Appropriate format is used that clearly presents data and its significance.
Calculations	Does not complete some calculations, or results are incorrect b/c of errors in analysis or calculations.	All calculations are attempted but contain some minor errors. Results should obey expected trends even if not accurate.	All calculations are completed without errors. Any sources of uncertainty are clearly identified when necessary. Results may be compared to literature values where appropriate.

Data fitting	Fitting results are inaccurate. E.g. no fitting attempted, or used inappropriate fit equation, or resulting fit does not resemble data trend.	Generates some error in fit results. E.g. resulting fit does represent data trend but values of adjustable parameters are not appropriate; or fit is adequate but not over appropriate range of data.	Obtained accurate fit results. Used correct equation and parameters, resulting fit accurately represents data, fit performed over appropriate range, obtained accurate values for adjustable parameters.
Questions	Questions are either not addressed or answered incorrectly.	Attempted to address all questions appropriately but made some errors.	All questions are answered to best ability using the data obtained.
Writing			
	Report may be confusing in parts, or is written in such a way that sections are ambiguous. Or, routinely makes errors in grammar, citations, or quotations. Or, does not explain some data, tables or figures.	Report is generally written in a professional manner but contains multiple grammatical errors or poorly written parts. (e.g. is not concise, is not focused, contains irrelevant and distracting information) Might have a few errors in making citations or quotations.	Report accurately describes all data and analysis in a well-written, logical presentation. Writing is w/o grammatical error, follows professional guidelines for scientific writing (e.g. fact-based, impersonal, and 3rd person perspective) and makes citations and quotations properly.