



Chemistry 125

Physical Chemistry Laboratory
Spring 2007



Course Goals

- See the **experimental evidence** for the basic concepts of physical chemistry
- Further develop **experimental skills** in laboratory
- Increase your knowledge of **uncertainty** and how to handle it!
- Effectively **communicate** scientific findings in writing and oral presentations



Experimental Evidence

- Quantum mechanics, statistical mechanics, thermodynamics, & kinetics *work* !
 - What is the evidence that the “Boltzmann factor” or “particle in a box” exist in reality???
 - How do you set up an experiment to test these values and concepts?



Experimental Skills

- Get familiar with measurement techniques for molecular and macroscopic properties
 - spectroscopy, x-ray diffraction, NMR
 - heat capacities, heat of combustion, kinetics
- Work with modern laboratory devices and instruments
 - lasers, light detectors, computer data acquisition, vacuum equipment, temperature and pressure measurements, Fourier transform techniques...



The Chem 125 Teaching Team

- Instructor:
 - Professor Charles V. Shank
- Laboratory Manager:
 - Edmundo Angeles
- Teaching Assistants:
 - Emily Chu
 - Phil Croteau
 - Allison Caster
 - Andrew Duffin
 - Matt Graham

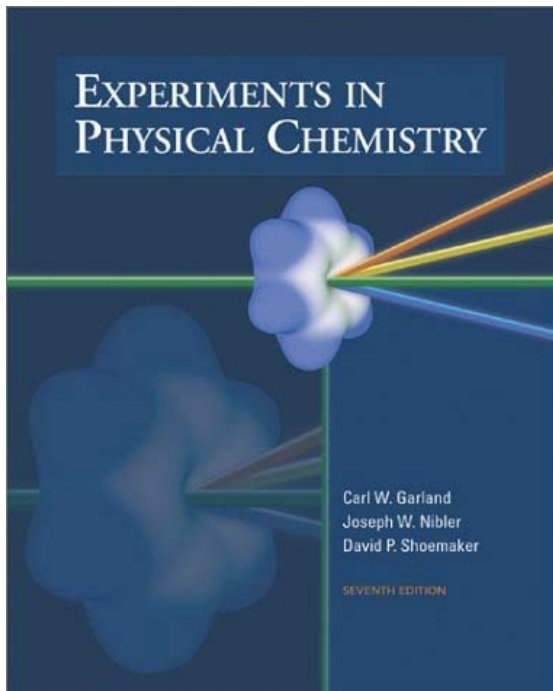


Handouts

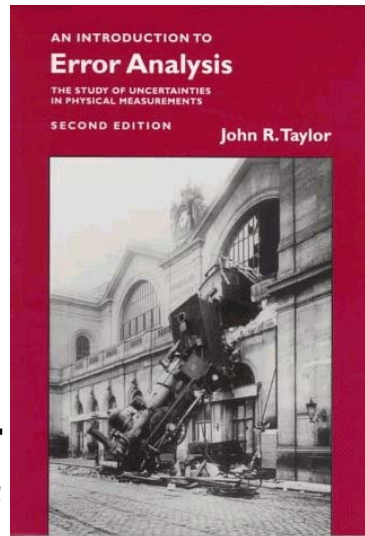
- Syllabus
- Outline of Experiments
- Guide to Written Reports/Guide to Oral Reports
- Reference Guide

Textbooks

Required:

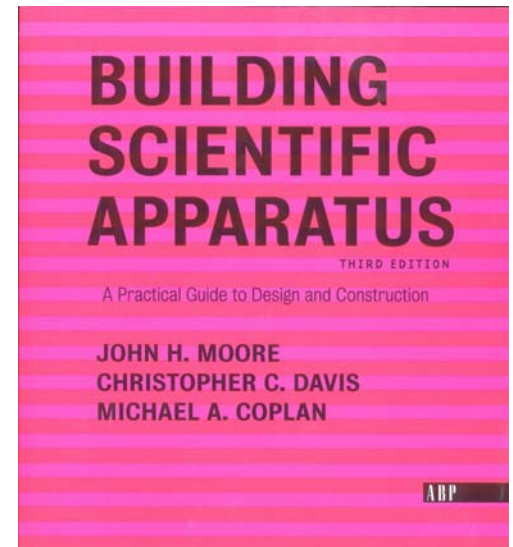


Garland et al.
*Experiments in
Physical Chemistry*



Taylor
An Introduction to Error Analysis

Recommended:



Moore et al.
Building Scientific Apparatus



Course Overview

- **One day of lecture per week**
 - 180 Tan
 - Not coordinated with labs
- **Lab M-F, 1-5 pm**
 - 301 Latimer
 - Sign up in advance for experiment time
 - Do experiment on the day you (or partner) are registered
- **Pre-labs scheduled throughout the week**
 - 301 Latimer
 - 2 pre-labs per experiment
 - Sign up in advance; contact GSI if you have conflicts
- **Lab materials in P-Chem Stockroom M-F, 1-5 PM**
 - Across the hall from 301 Latimer



Outline of Experiments

**Group I: Spectroscopy
(Weeks 2-5)**

**Group II: Kinetics and Thermodynamics
(Weeks 6-10)**

**Group III: Condensed Phase Structure
and Dynamics
(Weeks 12-15)**



Lab Organization

- Perform 6 experiments
 - Choose 2 from each group
- Must complete (at least) one of the two computerized labs (LabView)
 - Heat of Combustion (Group II) *OR* Heat Capacity of Nickel (Group III)
- See *Outline of Experiments* for descriptions



Group I: Spectroscopy

- A. Infrared Spectroscopy
- B. Vibronic Spectroscopy
- C. Raman Spectroscopy
- D. Magnetic Susceptibility



Group II: Kinetics and Thermodynamics

- A. Kinetics of the Reaction of Iodine with a Ketone
- B. Fluorescence Quenching in Gaseous I_2
- C. Physical Adsorption of Gases
- D. Heat of Combustion: Bomb Calorimeter (LabView)
- E. Knudsen Effusion



Group III: Condensed Phase Structure and Dynamics

- A. Light Scattering and Brownian Motion
- B. Pulsed Nuclear Magnetic Resonance
- C. X-ray Diffraction
- D. Heat Capacity of Nickel at Low Temp.
(LabView)
- E. Fluorescence Microscopy



Lab Reports

- 2 Written Reports, 4 Oral Reports
 - First report must be written
- Work on experiment in pairs
- Submit lab reports individually
- See lab report guidelines



Lab Reports: Due Dates

- Due dates (Friday by 5 pm):
 - Feb. 16
 - March 2
 - March 16
 - April 6
 - April 20
 - May 4
- Oral reports will be Wed.-Fri. by appointment



Lab Reports: Grading

- Lab reports each worth 50 points
- Late reports (up to one week), -5 points
- No reports accepted for credit after one week late
 - After one week overdue, report is worth 0 points
 - **HOWEVER**, you must complete 6 experiments **AND** submit all reports in order to pass the course!



Pre-labs

- Attend a pre-lab prior to performing each experiment (Required)
- Pre-labs for first experiment:

Experiment	GSI	Pre-lab Schedule
IR Spectra of HCl, DCl, CH ₄	Matt	Friday Jan 19 @ 2:15 & Tuesday Jan 23 @ 3:15
IR Spectra of NH ₃	Andrew	Thursday Jan 18 @ 2:15 & Monday Jan 22 @ 3:15
Electronic-Vibrational Absorption Spectrum of Gaseous I ₂	Emily	Thursday Jan 18 @ 1:15 & Monday Jan 22 @ 2:15
Raman Spectroscopy	Allison	Wednesday Jan 17 @ 4:15 & Tuesday Jan 23 @ 1:15
Magnetic Susceptibility	Phil	Friday Jan 19 @ 1:15 & Tuesday Jan 23 @ 4:15



Lecture Schedule

- Jan. 17 Introduction to Physical Chemistry Lab: Overview and goals
- Jan. 24 Error analysis I
- Jan. 31 Error analysis II
- Feb.7 Spectroscopy and Applications I
- Feb. 14 Spectroscopy and Applications II
- Feb. 21 Computer data collection and Demo of LabView: Part I
- Feb. 28 TBA
- March 7 Computer data collection and Demo LabView: Part II
- March 14 Light detectors and Light sources
- March 21 Vacuum techniques and Pressure measurements
- March 28 Spring Break
- April 4 Techniques to improve signal-to-noise ratio
- April 11 TBA
- April 18 TBA
- April 25 Course review
- **May 2 In-class Final**



To Do Today...

- Read over the *Outline of Experiments* and select one
- Select a partner for the first lab
- Go to the P-Chem Stockroom and check in
 - If you have a conflict, do this by FRIDAY, JAN 19
- Pick up and read the lab policies
- Sign up for a pre-lab
- Sign up for the first experiment
- Pick up a copy of the laboratory instructions for your experiment



How to do well in this course ?

- Keep up with the lecture materials
- Pay attention to pre-labs
- Never miss a lab or lab report
- Do homework
- Spend adequate time preparing reports



First Assignment

- Read Chapter 1 & 2 of Garland et al.
- Read Chapter 1 & 2 of Taylor
- See “Week 1 Checklist” for more details



Questions?

Go to the lab!