

CHEM 324: Physical Chemistry Laboratory I
Abridged Syllabus
Fall 2008

Instructor

James McCormick

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Office Hours

As posted, by appointment or whenever my door is open.

Laboratory

Wednesday, 13:30 – 16:20

Thursday, 08:30 – 11:20

Thursday, 13:30 – 16:20

All laboratory sections meet in Magruder 1026 and will meet during the first week of class.

Required Materials

Laboratory Manual There is **no** lab manual for this course. You will be performing exercises from the *Journal of Chemical Education*, Garland, C. W.; Nibler, J. W. and Shoemaker, D. P. *Experiments in Physical Chemistry*, 7th Ed.; McGraw-Hill: New York, 2003 and Halpern, A. M. and McBane, G. C. *Experimental Physical Chemistry*, 3rd Ed.; W. H. Freeman: New York, 2006. Modifications to these exercises, along with helpful hints are available on the Physical Chemistry Laboratory page on ChemLab.truman.

Laboratory Notebook All students are required to have a bound laboratory notebook. You may purchase a duplicating notebook if you want, but a composition notebook with numbered pages is acceptable for this course. Regular spiral-bound notebooks are unacceptable as laboratory notebooks. See the Laboratory Notebook page of ChemLab.truman for more information on the laboratory notebook.

Safety Equipment All students must purchase safety goggles that meet the ANSI Z87 or Z87.1 safety standard. Safety goggles and proper attire are to be worn at all times in the laboratory; inappropriately attired people will not be allowed in lab. Please see the Laboratory Safety page on ChemLab.truman for more information on safety in the chemical laboratory and review your CHEM 245 notes on chemical safety.

Calculator A hand-held scientific calculator (can perform logarithms, scientific notation and exponentials) is required. Bring your calculator to all laboratory sessions. No loaner calculators will be available!

Computers You are expected to be skilled in the use of commonly-encountered software including web browsers, word processing programs, spreadsheets and Mathematica.

Forms Before coming to laboratory you are to fill in, print out and sign the health form and the safety/lab policies contract form from the Physical Chemistry Laboratory web page

(<http://chemlab.truman.edu/PhysicalChemistry.htm>). Be sure to use the correct forms! Bring the correct completed forms to the next laboratory meeting. You will not be allowed to start working in the laboratory until the correct forms have been turned in.

Announcements and other course information will be posted on-line at <http://www2.truman.edu/~jmccormi/P-Chem1/PChem1.htm> (not on the CourseInfo system).

Course Objectives

To reinforce the concepts of physical chemistry through laboratory work.

To foster independence and critical thinking skills in the laboratory.

To foster an appreciation of chemistry as a physical science that is based on accurate, precise measurements and mathematical models.

Course Requirements

My expectations of my students (and myself) are that they will work hard, with no shortcuts and no excuses, and that they will come early and be prepared to fully participate in the class.

The information given below is specific to this course. Please see my general syllabus (<http://www2.truman.edu/~jmccormi/GeneralSyllabus.htm>) for a complete listing of my policies.

You and a lab partner (or partners) will complete four three-week exercises and write a formal laboratory report for each exercise to the standard of an American Chemical Society journal. You will be assigned a set of exercises in the areas of thermodynamics, phase equilibria, chemical equilibria and kinetics. You will be provided with some background information for each exercise; however it will be up to you, for most of the exercises, to design the experiments to obtain the desired result.

At the start of each laboratory session I will quickly assess your notebook to see whether it is properly prepared (see http://chemlab.truman.edu/Notebook_Files/BeforeLab.htm to review what is expected). I will then sign and date your notebook. I will also sign and date your notebook at the end of the laboratory session. Other than these signatures, I will not be checking your notebooks. However, this is subject to change with little or no warning!

Each formal laboratory report will follow the format given on the ChemLab web page (http://chemlab.truman.edu/LabReports_files/LabReports.htm). Helpful hint: this page gives you a template to follow, use it! These reports are to be less than ten (10) pages long, excluding tables, figures, references and supplemental material.

Some notes on specific sections of the laboratory report. There should be a brief (less than three pages), but thorough, *Introduction* that informs the reader of the problem to be solved and which may present the important formulas to be used. The *Introduction* should start from a big, general picture and end with a specific statement of what is to be studied, how it will be studied and what will be learned. Note that the methods that you are using are not the main focus of your report. Rather, you are using instrumental and chemical methods to

address a chemical problem, which is the main focus of the report. For example, if you are attempting to measure a solubility of a slightly soluble salt using electrochemistry, electrochemistry is not the main focus of the paper (the solubility of the salt is). However, it is appropriate to give the reader some background on the methods to be used. In the same way, you do not need to derive any formulas in the *Introduction*, except if the derivation is crucial to the reader's understanding. In some cases, you can even present the equations in a *Results and Analysis* section.

The *Introduction* is followed by a brief *Experimental* section. You should state where you got your materials, what instruments you used and what, if any, literature procedures you followed, but you should not give a step-by-step instructions on how you did everything. If you followed the given procedure exactly, say so, and reference the literature method. But if you changed the literature procedure, describe what was changed. If you substantially changed the procedure, then write a new one.

The next section is the *Results* section where you describe your results in words (simply stating numbers is insufficient!) and any issues you encountered that might affect your final result. Include at least one example of each spectrum, kinetics run, graph, etc. that you obtained or made (if you must have all of them, put the others in *Supplemental Material*). The last section is the *Discussion of Conclusions* (see the Lab Notebook link of ChemLab.truman for a description of what to include in this section, and some handy outlines, too). This section will be the longest, but still not more than four pages, or so. You may combine the *Results* and *Discussion* into a *Results and Analysis* section, if that allows you to present your results in a more meaningful way to the reader. For your references, be sure to follow the standard short ACS format (no titles in journal articles) and you must have a three references beyond what is given to you as a hardcopy or on the Physical Chemistry web page. At least one of these must be from the primary literature (i. e., not a textbook, instrument manual, or a compendium of information such as the Merck Index, the CRC or Wikipedia).

You are expected you to turn in at least two revised drafts of each report. You may ask other students or the Writing Center to read a draft of your report and the reader **must** sign and date their revised copy. Be considerate! When you ask someone to read your formal report, tell them the date that you will have the manuscript to them and then give them the final draft (with all figures and tables) on the arranged day!

You are expected to do a standard statistical analysis on your data and to perform a formal propagation of error analysis whenever possible (see the *Data Analysis* page on Chemlab to review statistical data treatment and propagation of error analysis). When a formal propagation of error analysis is not possible, quantitation of uncertainty and a discussion of its effect on the final calculated value is expected. If I don't see evidence of people doing the statistical and propagation of error analyses, I will ask for these to be turned in with the formal reports.

Formal reports will be due in lab two weeks after the laboratory work is completed (see the class schedule for the exact dates). The last formal report will be due on your lab day during Finals Week.

Grading

I will assess each report using rubrics adapted from those found on the ChemLab web page (see <http://chemlab.truman.edu/Assessment/Assessment.htm>). The point distribution for each exercise is given in the table on the next page.

Your final grade will be determined from the number of points that you earned out of the 600 possible. If the actual class distribution is significantly lower than shown, the grading scale may be adjusted at the instructor's discretion. In any case, the grade cutoffs will not be raised. As this is a major's laboratory course, I expect that the majority of students in the class will earn an A or a B. However, I will use the entire grading scale.

<u>Grade</u>	<u>Total Points Earned</u>	<u>Cut-off</u>
A	> 540	average + 2σ
B	480 – 539	average + σ
C	420 – 479	average
D	360 – 419	average - σ
F	< 360	

A student whose grade is below a cut-off by 15 points or less will be considered for the next higher grade. The criteria for promotion include an improvement on the formal reports, laboratory citizenship, participation and attitude (in that order).

Class Schedule

Date	Laboratory Exercise
8/25 – 8/29	Check-in
9/1 – 9/5	Start Exercise 1
9/8 – 9/12	
9/15 – 9/19	Finish Exercise 1
9/22 – 9/26	Start Exercise 2
9/29 – 10/3	Exercise 1 Report Due
10/6 – 10/10	No lab because of Fall Break
10/13 – 10/17	Finish Exercise 2
10/20 – 10/24	Start Exercise 3
10/27 – 10/31	Exercise 2 Report Due
11/3 – 11/7	Finish Exercise 3
11/10 – 11/14	Start Exercise 4
11/17- 11/21	Exercise 3 Report Due
11/24 – 11/28	No lab for Thanksgiving Break
12/1 – 12/5	Finish Exercise 4, Check-out
12/8 – 12/12	Finals Week, Exercise 4 Report Due
12/10	Reading Day

Source	Points
Attendance/promptness 10 points for each week in lab distributed as follows	30
Comes early	+5
On-time	+3
< 5 minutes late	+2
5 – 10 minutes late	+1
> 15 minutes late (or notebook not signed)	0
Leaves by end of session	+5
< 5 minutes long	+3
5 – 10 minutes long	+1
> 15 minutes long (or notebook not signed)	0
Laboratory citizenship (5 points for each week in lab)	15
Outstanding (✓+)	5
Good (✓)	4
Iffy (~)	3
Poor (✓-)	2
Very Poor (-)	0
Laboratory notebook (for each of statement of purpose, background and procedure)	10
Outstanding (✓+)	4
Good (✓)	3
Iffy (~)	2
Poor (✓-)	1
Missing (-)	0
Format of formal report (all sections present, in proper order)	5
Abstract	5
Introduction	10
Experimental	5
Results	10
Discussion of Conclusions	15
Grammar/style	10
Precision/accuracy of results (compared to literature values, which must be stated)	10
Error analysis performed and used	10
Rough and revised drafts of formal report (two or more)	10
References (three beyond given, one primary)	5
Three or more	+5
Two	+3
One	+1
None	0
Total	150

Student Information
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Official Name: _____

Preferred Name: _____ Banner ID Number: _____

Anything I should know (IEPs, conflicts, etc.): _____

I attest that I have read and understand the course policies set forth in the abridged (handed out in class) and in the general syllabus (<http://www2.truman.edu/~jmccormi/GeneralSyllabus.htm>).

The Federal government has ruled that “leaving personally identifiable, graded papers unattended for students to pick up” violates student privacy. *By signing below, you indicate that you will allow me to place your graded papers in a public place for you to pick up.* If you do not sign, I will hand back your papers to you personally.
