

CHEMISTRY 236, FALL 1999

Instructor: Joel Tellinghuisen [SC5521; Office Hours 12-1 MWF, 4-5 T, 5-6 W]
Assistants: Angie Anderson [SC7850, Ph 3-9411]
Deborah Boxall [SC7850, Ph 3-9411]
Elliott Easterly [SC5430, Ph 3-6087]
Lab Hours: 1:10-4:00 p.m. MTR [SC7510]
Lectures: 4:10-5:00 p.m. Wednesdays [SC5212H]
Lab Text: *Experiments in Physical Chemistry* (6th edit.) by Shoemaker, Garland, and Nibler.
Physical Chemistry Laboratory Campus Class Pak (available at Campus Copy, Rand).
Web Site: <http://www.vanderbilt.edu/AnS/Chemistry/Tellinghuisen/>

Week of	Schedule	Activity	Experiments (# in lab text)
August 23		lecture	1. Thermal Expansivity of a Liquid
August 30		lecture	2. Bomb Calorimetry (6)
September 6		lecture	3. Inversion of Sucrose (22, modifications)
September 13		lecture	4. The Triple Point of a Substance
September 20		laboratory	5. Freezing Point Depression (11, mods.)
September 27		laboratory	6. A Spectrophotometric Study of Equilibrium
October 4		laboratory	7. Physical Adsorption of Gases (26)
October 11		lecture	8. Gas Kinetics (24)
October 18		laboratory	9. Binary Liquid-Vapor Equilibrium (14, mods.)
October 25		laboratory	<u>Note:</u> Experiments 1-4 constitute a core of required experiments, and 5-9 are optional experiments (see below). The theoretical background needed to understand these experiments is modest — within the scope of general chemistry in most cases. However, Experiments 5-9 do contain components that may not have been encountered previously, and in some cases may not be treated at all in Chemistry 230. Still, all are provided with adequate support material to make them self-contained.
November 1		laboratory	
November 8		laboratory	
November 15		lecture and review	
December 1		Exam	
<u>Note:</u> On laboratory weeks, students should go directly to the laboratory.			

Grade Computation: 25% each for problem sets and exam, 50% for laboratory work, including results, analysis (including error analysis), and reports. Final grades will be assigned on the basis of absolute point scores, assuming a nominal total of 400 [20 for each of 5 problem sets, 25 each for lab results and analyses (6), 25 for each of 2 reports, and 100 for the exam]:

A	360	A-	350	B+	340	B	320	B-	310
C+	300	C	280	C-	270	D+	260	D	240
D-	230								

There will be some bonus points in addition to these 400. Included among these are 25 "peer points," to be allocated by each student to his lab partners (see below). The most extreme distribution allowed is 18-7.

Vanderbilt Honor Code: In effect for all work. Lab teams are expected to collaborate on lab work, as discussed more fully below. Students should write and sign the following on each graded assignment: "I pledge my honor that I have neither given nor received unauthorized aid on this assignment." For the purposes of this course, "unauthorized aid" includes (but is not limited to) the use of manufactured data ("dry-labbing") and the use of problem solutions, data, and reports obtained by other students in this or in previous years of this course.

Students will need goggles and bound notebooks (available in the bookstore); and a lab coat is recommended (purchasable from the Chemistry Storeroom). Students must wear safety goggles, full-length pants or lab coats, and shoes at all times while working in the lab. Sandals are not allowed, nor are foods and beverages. Shorts are permitted only under lab coats.

The course will meet 7 times for lectures and exam and 7 weeks for laboratory experiments. Students will work in teams of three in the lab. Each team will submit a single report for each experiment, with all partners sharing credit for the results and data analysis but with only the main author receiving a grade for the report. Each student will author two reports during the semester; the format for these will be discussed in class. Every team should complete six experiments, including the four core experiments. However a team may elect to complete fewer than six, in which case arrangements must be made for more than one member to submit a report on the same experiment. Lab teams will of course collaborate on the collection of data; they are also strongly advised to do so on their analyses. Report authors are both authorized and encouraged to have their lab teammates critically review their reports. All other work should be done independently, under the honor code.

Writeups for all of the 9 experiments are included in the Class Pak. About half of these follow the descriptions in the lab text fairly closely. In addition some supplementary material will be made available in the laboratory, the library, and on the course Web page.

The laboratory will be operated on the "station" principle: All required setups will be in place throughout the semester, and students will work at the different experiments in accord with a sign-up schedule. There will be two stations for each of the four required core experiments, but only one for each of the five optional ones. The only provision for repeating botched experiments is the inclusion of the 7th week of experiments in the schedule, *i.e.*, students will be allowed to work only on their scheduled lab days. Students who do not need to use the 7th week for repeat work may do a 7th experiment that week, for bonus credit.

Students should come to lab on experiment days prepared to work efficiently and should record all "manual" data directly in their bound notebooks in ink. These notebooks should be submitted along with the reports, so each team will need three notebooks, one for each team member. In addition, students should utilize wise "backup" procedures to ensure against loss of data. The notebook should be initialized by the TA or instructor at the end of each lab day. This constitutes a key part of the "check-out" procedure, and students without such clearance will be liable for any damage or breakage subsequently found at their stations. For some experiments a copy of key data may also be required at the end of the day; check with the TA in charge of the experiment.

To encourage advance preparation for the experiments, we will hold pre-lab orientation sessions in the scheduled lecture time slot (W 4:10) each week that lab is in session. Also, each student will take a written quiz to be given at 1:10 p.m. on the day of the scheduled lab work. Quizzes will be administered by the TA in charge of the experiment and will count for 5 of the 25 "results and analysis" points for the experiment. The quizzes will be based on a number of "Study Problems" included near the end of each writeup in the Class Pak. Answers to these problems will be made available in advance.

Reports are due at 4:00 p.m. on the regular lab day, one week after the completion of the experimental work. Late lab work will result in the loss of 10% (absolute) per late day. Students who encounter unanticipated problems or serious delays may elect to "punt" on the delayed work and do the same or a different experiment later, provided this can still be accommodated in the schedule. [Exceptions to late policy: Delays occasioned by equipment problems beyond the control of the students will be accommodated through special arrangements.]

The experiment stations must be left in a condition that will permit the next team using the setup to proceed immediately with their work. Follow the outdoorsman's rule: Leave the site better than you found it. Any carelessness that causes a subsequent team to lose time will result in the loss of 5 of the 25 points for the "results and analysis" part of the experiment. This includes unreported breakage of equipment and spillage of chemicals or water away from the setup, *e.g.* on or by the balances.

The lecture part of the course will heavily emphasize the processing, analysis, and display of data. The main tool for this instruction is a program called KaleidaGraph, ~30 copies of which are available in the Stevenson Computer Classroom and on both the Macintoshes and PCs in Branscomb. The vehicle for this instruction is the five problem sets included in the Class Pak. These begin with self-instruction tutorials and move toward small data analysis projects. Homework will be due at 4:10 p.m. on Wednesdays, in accord with the due date listed on each problem set — the first four in the first four weeks, the last late in the term. Late homework will not be graded.

A single exam is scheduled for the last regular lecture period in the course. This exam will be comprehensive, with roughly $\frac{1}{3}$ on data analysis and the rest on the experiments. Since not everyone will be doing the same experiments, there will be options on the test. Students may work for as long as two hours on this exam.