CHEMISTRY 236 — FALL 2009

Instructor: Joel Tellinghuisen [SC5521; Office Hours 12-1 MTR, 5-6 W]

Assistants: Seth Byers
Ian Olmsted
George Rouvelas

Lab Hours: 1:10-4:00 p.m. MTR [SC7510]

Lectures: 4:10-5:00 p.m. Wednesdays [SC5211]

Lab Text: *Experiments in Physical Chemistry* (7th edit.) by Garland, Nibler, and Shoemaker (rec).
Physical Chemistry Laboratory Class Pak (available at Campus Copy, Rand, required).

Web Site: http://www.vanderbilt.edu/AnS/Chemistry/Tellinghuisen/

Schedule

Week of	Activity
August 26 (**W**)	Comp; Lec (Intro, Stats)
September 2	Comp; Lec (1,2)
September 9	Lec (5,7)
September 16	LAB; Lec (4); **Q1** (SP1-18)
September 23	LAB; Lec (3,6)
September 30	**Q2** (Stats - all)
October 7	LAB; Lec (8,9)
October 14	LAB
October 21	
October 26 (**M**)	**Q3** (Ex1, Ex2)
November 2	LAB
November 9	LAB; **Q4** (Ex3, Ex4)
November 16	makeup LAB
November 30	**Q5** (Electives & review)

Note: On LAB weeks, students go to SC7510 on their lab day; for Comp, Garland 119. Q = quiz; SP = Statistics Problems; Ex = Experiment.

Experiments (# in lab text)

1. Temperature and Pressure Calibration
2. Inversion of Sucrose (22, modifications)
3. Bomb Calorimetry (6)
4. The Triple Point of a Substance
5. Spectrophotometric Study of Equilibrium
6. Freezing Point Depression (11, mods.)
7. Thermal Expansivity of a Liquid
8. Physical Adsorption of Gases (26)
9. Binary Liquid-Vapor Equilibrium (14, mods.)

Experiments 1-4 constitute a core of required experiments, and 5-9 are electives (see below). The theoretical background needed to understand these experiments is modest — within the scope of general chemistry in many cases. Further, the Class-Pak writeups include theoretical and other support material to make them self-contained; and all experiments will be treated in the lecture portion of the course. For the core experiments, all work must be completed and submitted at the end of the lab day (by 4:30 p.m.).

Grade Computation: Based on laboratory work (results, analysis, and reports — 6×25 + 2×15), quizzes (3×25 + 50 + 6×5), computer exercises (4×10), and peer points (24). Final grades will be assigned on the basis of absolute scores:

A 345	A– 330	B+ 315	B 300	B– 280
C+ 270	C 250	C– 230	D+ 220	D 210
D– 200				

Each team receives a single grade for each lab, only 2 of which involve reports (elective experiments). The quizzes include prelab quizzes taken (individually) at the start of the lab period. The peer points are allocated by each student to his/her lab partners (see below). Lecture quizzes will be best 3 of Q1-Q4, + Q5.

Vanderbilt Honor Code: In effect for all work. Lab teams collaborate on all 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 data and reports obtained by other students in this or in previous years of this course. A violation will cost 100 points.

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.

Laboratory work is scheduled for seven weeks, with the last being for makeup work only. Students will work in teams of three, to be constituted by random number generation. Each team will submit a single set of results/report for each experiment, with all partners sharing credit. Six experiments should be completed, including the four core experiments. Collaboration with other teams is not allowed, unless otherwise specified in special cases.

Laboratory submissions should not be elaborate. The key is clarity. Each submission should be complete and sufficiently well organized that the instructor grading it can follow it easily. Attention will be devoted to the preparation of good tables and figures, properly labeled, with self-sufficient captions.

Writeups for all of the nine experiments are included in the Class Pak. About half of these follow the descriptions in the lab text fairly closely. While the lab text is not required for the course, it is strongly recommended that each team have at least one copy among them.

The laboratory is operated on the "station" principle: Most setups are in place throughout the semester, and students work at the different experiments in accord with a sign-up schedule. All students will do Experiment 1 in either the first or the second scheduled lab week. (Their second experiment in this two-week period must be 2, 5, or 7.) There are two stations for each of Experiments 2–4, but only one for each of the elective experiments (5-9). Thus, teams should plan ahead to ensure that they get their preferences for the two elective experiments. The only provision for repeating botched work is the inclusion of the makeup week in the schedule; *i.e.*, students will be allowed to work only on their scheduled lab days.

Students should come to lab on experiment days prepared to work efficiently. All entries in the notebook must be in ink. The notebooks must be submitted along with the results/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 main notebook for the experiment must be initialized by the 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 all experiments, either final or preliminary (for electives) results and analysis must be submitted at the end of the period, as specified in the CP writeup.

To promote advance preparation for the experiments, PowerPoint (PP) presentations are available on the course web site. Each student will take a short, 5-point written quiz at 1:10 p.m. on the day of the scheduled lab work. These quizzes will be based on the experimental procedures, as covered in the Class Pak, the PP document, and the PreLab Preparation questions in the Class Pak.

Reports for elective experiments are due at 4:30 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% per late day. Teams that encounter unanticipated problems may elect to "punt" and do the same or a different experiment in the makeup week. This may be done only once; and students should schedule ONLY such makeup work in makeup week, as no prelab quizzes will be offered then. [Exception: 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 us or another team to lose time will result in the loss of as many as 10 team points for the experiment. This includes incomplete cleanup, 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 be devoted to the statistics of data analysis and the theory and practice of the experiments. Mastery of the Statistics Problems and the Study Problems included at the end of each writeup in the Class Pak is essential for understanding the subject matter of this course and for doing well on the quizzes. Answers (often very terse!) are provided on the course web site. In addition, you are encouraged to collaborate with your colleagues in work on these problems. Your mastery will be tested on the five scheduled quizzes.

The primary tool for data analysis and presentation in the course is the KaleidaGraph (KG) program, the latest version of which is available in the Microcomputer Lab. The Class Pak includes four KG assignments worth 10 points each. You may collaborate on these assignments as you like.

Students will have 24 peer points (total) to allocate to their lab partners (maximum to one partner = 18). This distribution will need to be submitted before Dec. 4 (you will be reminded). It is not necessary to allocate all 24 points. Students who fail to submit allocations will have their points distributed 12:12 (*i.e.*, it is not necessary to submit these if you are happy with the 12:12 distribution).