

## Chemistry 303 Spring, 2012 Course Guidelines

Instructor: Daniel Graham, Flanner Hall Room 401 (office, 773 508-3169); Loyola Chemistry Office: 773 508-3100; FAX: 773 508-3086; Email: dgraha1@luc.edu.

Course Assistant: Jon Derouin

Lab Times: M, F 0830 – 1230; W, 1445 – 1835.

Places: Flanner 315, NMR, and quantitative analysis labs.

DJG Office Hours: M, W 1230 - 1330, Thursday, 1130 – 1230, or by arrangement.

This course will introduce laboratory techniques and analysis central to physical chemistry. We will pursue the following activities:

- (1) The quantification of information in experimental data. Mass spectra, IR spectra, and protein compositions will be the objects of interest.
- (2) The statistical analysis of experimental data: strategies for dealing with ignorance and uncertainty. Measurements will focus on solution densities, crystallization velocities, electrochemical potentials, and evaporation rates.
- (3) The application of mathematical models to experimental data. Measurements will re-visit crystallization velocity. Temperature and time measurements will also be featured.
- (4) Techniques and practice of numerical integration and differentiation. Measurements and analysis will involve thermodynamic isotherms and infrared spectra.
- (5) Techniques and applications of Fourier spectral analysis. Two lab meetings are devoted to spectral analysis, infrared and laser light diffraction experiments.
- (6) Experimental measurements of  $\pi$ . Let us measure  $\pi$  four different ways.
- (7) Techniques and applications of fourier transform nuclear magnetic resonance.
- (8) Techniques and applications of circular dichroism measurements: proteins will be the systems of interest.
- (9) Experimental study of periodic precipitation in electrolyte solutions.

### Course Structure:

Chem 303 will consist of experiments and lessons in data analysis, presentation, and reporting. Consultations with DG and course assistant (Jon Derouin) will be a feature of every lab meeting.

Lab quizzes will transpire at the start of four lab meetings. A mid-term exam will occupy one of the lab meetings. Yet another meeting will focus on the experimental measurement of  $\pi$ . The last few weeks will concentrate on NMR, circular dichroism, and periodic precipitation experiments. A research-style paper will be written by each student on one of these three experiments.

Students will work both individually and in two- to three-member teams. Teams can remain fluid throughout the semester.

### **Grading:**

Grades will be determined on the basis of four areas with equal weight factors:

Lab Consultation Points: 25%

Lab Quizzes: 25%

Mid-term exam: 25%

Completion of NMR, circular dichroism, and periodic precipitation experiments plus research-format paper: 25%

The following scale will be used:

90% - 100% A ; 80% - 89% B; 70% - 79% C; 60% - 69% D; < 60% F

Team work is integral to each lab meeting. However, points and grades will be grounded on individual effort and achievement. Laboratory pchem is neither easy nor a quick study, but the process is rewarding if good-faith effort is made. Students are urged to consult with DG to discuss problems before they become serious.

First Meeting: Logistics and Handouts

Second Meeting: The quantification of information in experimental data

Third Meeting: Quiz on second meeting material followed by the statistical analysis of experimental data

Fourth Meeting: Quiz on third meeting material followed by the application of mathematical models to experimental data

Fifth Meeting: Quiz on fourth meeting material followed by techniques and practice of numerical integration and differentiation

Sixth Meeting: Quiz on fifth meeting material followed by techniques and applications of Fourier analysis

Seventh Meeting: No quiz! Yet more Fourier Analysis!

Eighth Meeting: No quiz here either! And let us celebrate  $\pi$ -day!

Ninth Meeting: Mid-Term Exam. The exam will address essential material of previous lab meetings.

Tenth Meeting: Techniques and applications of Fourier transform nuclear magnetic resonance

Eleventh Meeting: Techniques and applications of circular dichroism measurements

Last Meeting: Experimental study of periodic precipitation

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### **The Ten Commandments of Physical Chemistry (adapted from SU handout)**

I. Thou shalt maintain an open mind.

II Thou shalt never take anything for granted; thou shalt check up early and often and make repeatedly sure of absolutely everything.

III. Thou shalt have a pretty good time and thy work shall be interesting.

IV. Thou shalt respect the intelligence of all parties.

V. Thou shalt not gather in small and divisive groups, nor do violence upon one another.

VI. Thou shalt fear no pchem problem. Yet shall ye fear and despise sloth, dullness, tastelessness, and gutlessness, for these will surely bring bad Karma and the wrath of Mother Nature.

VII. Thou shalt hacketh awayeth at pchem problems with dignity and helpeth thy associates to doeth likewise.

VIII. Thou shalt bendeth over backwards to recordeth data, observations, and questions that cometh to mindeth.

IX. Thou shalt admiteth thy mistakes, for they shall be forgiven.

X. Thou shalt rolleth and bounceth over and around the inevitable potholes. When everything aroundeth thee wirlleth and creameth and seemeth to falleth aparteth, thou shalt adjusteth and sayeth to thyself calmly, "This too shall pass".

**The PChem Motto:** No lies, no hate, no fear.