

CHEM 3420: Physical Chemistry II — Spring 2009

Independent Projects

This project is intended to be a fun introduction to independent thinking and research. You may choose an experimentally, theoretically, or literature oriented project. Students may work in pairs on experimental projects. In either case, the object is for you to propose a question and investigate the answer. Several possible projects are suggested here; you are encouraged to develop your own ideas.

Most any topic related to the material covered in Physical Chemistry I and II is acceptable, as long as the instructor approves it in advance. By **Friday, February 20**, you should submit your topic for approval. A 1–2 page proposal/summary of your topic, with an additional page of at least 3 primary (not WWW) references, is due **Wednesday, March 11**. This document is 15% of the project grade.

The last three lab sessions will be dedicated to project work, so experimental work is highly encouraged. Please be aware that experimental projects are limited by equipment and supply availability.

An 8–10 page paper (written individually) is due Monday May 4th (our extended class day). You will also make a 15 minute presentation to the class on that day. In preparation for the presentation you should provide 2 to 4 handout pages suitable for photocopying (single-sided 8.5x11 inches, no staples!) by the Friday before the presentation day. I will make copies of everyone's handouts and distribute them before the presentations.

Grades will be assigned on the basis of presentation, creativity, effort, completeness, relevance, and evidence that you've learned something new. Actual results are much less important than explanations and analyses. A few suggestions are listed below.

Extensions of existing laboratory experiments:

1. Kinetics of bromination of deuterated acetone or other ketones
2. Kinetics of the halogenation of acetone with a different halogen or catalyst
3. Further characterization of biodiesel, biodiesel of other oils
4. Exploration of the phase diagram of binary or ternary system, using DSC or other techniques
5. Other applications of bomb calorimetry

"New" laboratory experiments:

1. Studies of the physical properties of macromolecules, micelles, polymers
2. Study of oscillating chemical reactions
3. Enzyme kinetics or other kinetics experiments
4. Kinetics of photochromic substances
5. A P-Chem experiment that interests you, such as one from "Experiments in Physical Chemistry" by Garland et al. (available on reserve) or other texts (see me for those)
6. A P-Chem experiment that interests you from a recent issue of *J. Chem. Ed* (available on-line, talk to me for possible suggestions)

Literature-based:

1. Diffraction and crystallography
2. Solid-state phase transformations (nucleation, etc.)
3. Quasicrystals
4. Photonic crystals
5. A topic from a recent Annual Review of Physical Chemistry (available on-line)

Theoretically inclined:

1. Simulation of bonding or spectroscopy using Spartan
2. Analysis and application of other simple quantum mechanical models...particle in a ring, particle on a sphere, particle in a slanted potential, etc.
3. Simulation of coupled chemical reactions, such as those that determine atmospheric chemistry, or oscillatory chemical reactions