

An Example for Teaching Activity of Chemical Education

Planning an Activity that Foster Learning

This special group project is designed to help the student to solidify the understandings of this course and improve their higher order thinking skills. Students will need to submit their project proposals in the middle of the semester and the topic should be related to physical chemistry theory/principle. The students need to design, fulfill and present a totally different experiment from the standard experiments during the last three weeks of this course after finishing all of the standards experiments. One of the goals of this course is to adapt and show critical scientific thinking. And this special group project should be a good way to fulfill this goal.

Before this special group project, the students will have already finished six standard physical chemistry experiments with clear lab manuals and instructions. They should already have good lab techniques, know how to write good lab report, and gain the foundation of error analysis method. Now it's time to improve the course to a whole new level by a new experiment designed by the students themselves. The reason that I believe my students can do this is based on the belief that learning is a natural and spontaneous process. After proper guidance and instructions, the students should already have the ability to learn something by themselves. As for the experiment, they need to think independently from previous standard experiments. Also teamwork as a group, they need to think cooperatively and collaboratively.

The instructor still needs to facilitate the whole special project and make sure it goes smoothly. A clear instruction for this special project will be handed out to the students to help them understand this project better. After they submit the project proposals, the instructor and teaching assistants should try to decide whether this project is feasible and the instruments and chemicals needed for this project are available. The instructor can discuss with students about the details of this project and make sure this topic will be a good one. During the whole process of this special project, the instructor should always keep an eye on all these groups and make sure the students are making reasonable progress. In order to make sure every group members are contributing their fair share, a petition process is designed to have such group members dropped from the group (please see the attached instructions for detail).

The degree of success for this project is based on the consistency, clarity, relevance and interest of the project finished by the students. The instructor and the teaching assistant will grade this special project based on the guidance above. Both final lab report and poster presentation take factor in to the grade.

Instruction for Special Group Project

CHEM 457 Physical Chemistry Lab Fall 2006

You've learned lots about doing physical chemistry lab following the manual. It's time to work without one!

Due Dates

Project Proposal due date: **Wednesday, October 3**, in class.

Completed project due date: **December 5**, complete project report will need to be submitted, and poster will need to be presented during poster session.

General Description

For this special group project you will design an experiment of your interests, which should relate to the physical chemistry theory/principle you've learned. You choose the topic; you decide what instrument and chemicals are needed; you decide how to collect and analyze data; and you will tell other people what you learn from this experiment. This project requires you to synthesize all the material from this course. Hence, it's one of the best ways to solidify your understanding of this course.

You will work in groups with the same people who you are doing standard experiments with. Your project will be presented in a poster session during the last week of the lab section. In the poster session, each group makes visual materials that explain the project. Then, people wander around looking at the posters and talking to the presenters, thereby learning about the various projects. In our poster session, some members of each group are stationed at the poster to answer questions, while the others wander around to examine the projects. The poster-sitters and wanderers switch off after the wanderers have examined all the posters. The group will also need to write a lab report of your project. Both final lab report and poster presentation take factor in to the grades.

Some Idea for Projects

Good projects begin with very clear and well-defined idea. You should think of questions that interest you first, and then worry about how to collect and analyze data to address those questions. Generally, vague topics lead to uninteresting projects. Below is a list of eight successful project topics that have been done by past Chem 457 students.

This is not a list that you have to pick from, instead, consider the list a tool for generating ideas.

1. *Environmental Effect on Fluorescence Properties*
2. *Bomb Calorimetry Investigation of Sugar and Article Sweeteners*
3. *DNA Kinetics*
4. *Fluorescence Properties of Dyes*
5. *Bromination of Ketones and Aldehydes*
6. *X-ray Diffraction Spectroscopy*
7. *Evaluation of the Fractal Dimension of a Crystal*
8. *Nanoparticles*

Practical advice: You need to consider the availability of instrument and chemicals for your project. The instructor will do the best to help you source what you want but keep this limitation in mind when deciding the topic of your project.

Project Proposal

Your group should HAND IN ONE PROJECT PROPOSAL (with all group members' names on it) by the proposal due date given above. The proposal is a page or so describing what you plan to do. Be as specific as possible, describing what topic you want to investigate and generally how you plan to obtain data. The instructor and TAs will return the proposals to you with comments. The more detailed your proposal, the better feedback you get! Your proposal should address the following questions:

1. *What is the topic of your project?*
2. *What is the main theory/principle you base your project on?*
3. *What are the instrument and chemicals you need for this project?*
4. *How you will collect and analyze the data?*
5. *How the results will give you answer for your project topic?*
6. *What questions and/or concerns do you have about your project?*

The project proposal is not graded. It exists primarily for you to get feedback on your project idea.

Project Grading Guidelines

You will be graded by your TAs or instructor. Graders will be looking for the following characteristics:

Consistency: Did you find the answer to your project topic?

Clarity: Is it easy for your reader to understand what you did and the conclusions you made?

Relevancy: Did you use your physical chemistry theory/principle wisely to support your project?

Interest: Did you tackle a challenging and interesting topic?

Guidelines for Making an Effective Poster

An effective poster communicates your project in a clear and concise fashion. The poster should address the following six points: statement of the problem, data collection, analyses, results, discussion and conclusions. You should strive to make the poster clear. Avoid unnecessary clutter, and do not put too much information on any one page. Think about what you would want to see on other people's posters as guidance for creating your poster.

Procedures for When Group Members are not Contributing Their Fair Share

Each group should spread the work among members so that everyone shares in the project. If some group members do not contribute their assigned workload, or are unwilling to take on work, your group may petition to have such group members dropped from the group. The process of this petition proceeds as follows:

- 1) *Send an e-mail to the instructor explaining how the group members have not contributed adequately. ALL MEMBERS OF THE GROUP MUST BE SENT THIS E-MAIL. This is to ensure that everything is done openly.*
- 2) *The instructor will arrange a meeting with the group. Subjects of a petition who fail to attend the arranged meeting will be dropped from the group.*
- 3) *At this meeting, the instructor will make a decision on the petition.*

These petitions can be made until **November 1**. After this date, groups will not be split up. Students who have been dropped from groups must find another group or get special permission to work alone from the instructor. After one of these meetings, any group member who does not contribute after promising to do so will be dropped from the group.