CHEM 1898
CHEMISTRY OUTREACH IN NEW ORLEANS

Instructors:

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Prerequisites: CHEM 107, General Chemistry I
Co-requisites: CHEM 108, General Chemistry II

Training Sessions: TBA, in Percival Stern 5019

Course Objectives:

The purpose of this service learning course is the ***promotion of interest in the chemical sciences*** by illustrating fundamental concepts in chemistry in thought-provoking, but explainable ways to area high-school students. The chemistry demonstrations are not intended to be "black box magic shows" but rather experiences that sow seeds of interest in science. A freshman general chemistry level of chemistry is sufficient to perform these demonstrations. The demonstrations will ***make use of and reinforce concepts learned in General Chemistry***. The expectation is that Tulane students will obtain a different, more mature perspective of the material taught in General Chemistry if they are required to explain those concepts to others with demonstrations and clear, simple language.

Grading:

CHEM 1898 is a *no-credit* course. Students will be expected to perform a brief demonstration of 5-8 minutes. Each student will be responsible for their demonstration, but will work as part of a group to give a 40-45 minute presentation to a high-school/middle-school chemistry class. All demonstrations will be selected by the instructors and rehearsed with the instructors to ensure effectiveness and safety. Additionally, students will be expected to give a 5-8 minute demonstration in the Tulane Chemistry Department for a field trip towards the end of the semester. At the end of the course, students must submit a written report/journal (2 pages) summarizing their experience. The reports will be expected to address the following:

a) Did the chemistry outreach demonstrations help me to better understand the principles in chemistry that were taught in CHEM 107/108? If so, give examples.

b) Has participation in the outreach program made teaching as a career something I would consider?
c) Has participation in the outreach program sparked your interest in chemical research (if so, what type of research)?
d) What was the most rewarding part of the outreach experience?
e) What changes would you suggest to improve the outreach program?

Grading will be based upon the following structure:

Grading in the class is pass/fail. Attendance at all mandatory training sessions and demonstrations is required (to fulfill the 20 hours of service), as is the completion of a final written report. Evaluation will also take feedback from teachers and students in the classes receiving the demonstrations into account.

Additional Important Information:

1. ***CHEM 1898 will satisfy part 1 of the two-part service learning requirement that is required of all Tulane undergraduates.*** Specifically, the first requirement is completion of a service learning course at the 100-, 200-, or 300-level before the end of your sophomore year or fourth semester on campus. For details on the second part of the service learning requirement, see http://tulane.edu/cps/about/graduation-requirement.cfm. Students are not eligible to complete the second requirement for service learning until they have junior (3rd year) status.
2. Refer to the Tulane Public Safety website for safety information: http://tulane.edu/publicsafety/index.cfm

Resources:

1. Shakhashiri, B. Z. *Chemical Demonstrations: A Handbook for Teachers of Chemistry*; Volumes 1-5. University of Wisconsin Press: Madison, WI, 1983.
2. Summerlin, L. R.; Ealy, Jr., J. L. *Chemical Demonstrations: A Sourcebook for Teachers*, 2nd ed.; American Chemical Society: Washington, DC, 1988.
3. Hutchings, K. *Classic Chemistry Experiments*; Osborne, C., Johnston, J., Eds. Royal Society of Chemistry: London, 2000.
4. Wagner, B. D.; MacDonald, P. J.; Wagner, W. *A Visual Demonstration of Supramolecular Chemistry: Observable Fluorescence Enhancement upon Host-Guest Inclusion*. J. Chem. Ed. 2000, 77, 178-181.

The schools at which we will be doing demonstrations:

John Dibert Community School
4217 Orleans Ave.,New Orleans, LA 70119
Teacher: John-Henry Trant

SciTech Academy (a ReNEW School)
820 Jackson Avenue, New Orleans, LA 70130
Teacher: Nicki Anselmo

Outreach Overview:

The demonstrations for this course will take place in two parts. For the first part of the course, you will go to your respective school in groups to perform demonstrations. For the second part, a group of students from the ***SciTech Academy*** will come to Tulane for a field trip, where you will give a brief tour of the campus and department, discuss college with the students, and do several more involved demonstrations.

Part 1: School Visits

For the demonstrations performed at the school, each student will pick one of the five areas described below. Each section has a set of experiments that can be performed by one person in a short time. In addition, you will come up with a short presentation to help the students understand the chemistry behind the demonstration you are performing. There will be several days available to practice and prepare your demonstration.

Demonstration Areas:

1. Molecular Motion, Phases & Density

Objectives of the Demonstration: The purpose of this demonstration is to use condensed gasses from our atmosphere (liquefied Nitrogen and solid CO_2- dry ice) to explain the phases of matter in terms of molecular motion, as well as explore density. Processes such as the floating air bubbles on a cushion of evolving CO_2, and the expansion of a balloon filled with dry ice help to explain the concepts of density with phases of matter.

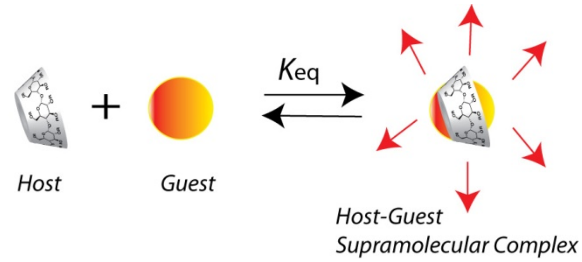
2. Chemical Kinetics- The Iodine Clock Reaction

Objectives of the Demonstration: The purpose of this demonstration is to teach students about an application of chemical kinetics through a visually stunning display. Students will view the Landolt Iodine Clock reaction, where two colorless solutions are mixed, and, after some time, the mixture suddenly turns dark blue. By performing the experiment with a variety of solutions in parallel, the demonstrators will show the concentration dependence of the reaction's timing. Demonstrators are encouraged to consult the above reference for additional background information and important insights regarding the teaching of key concepts.

3. Thermochemistry- Processes that Absorb or Release Heat

Objectives of the Demonstration: The purpose of this demonstration is to teach the students that all physical and chemical processes involving a phase change are accompanied by an enthalpy (heat) change. Phase changes include the dissolving of a solid into a liquid, the condensation of a gas or evaporation of a liquid, and the freezing of a liquid or melting of a solid. In most cases, the enthalpy change associated with a phase change is small and not easily noticeable. For instance, we don't notice a change in the temperature of a glass of water when we dissolve some sugar in it. This set of demonstrations illustrates some processes that are accompanied by very dramatic releases or absorptions of heat energy.

4. Supramolecular Chemistry (Selection from Journal of Chemical Education Articles)



Objectives of the Demonstration: The purpose of this demonstration is to introduce the concept of "supramolecular chemistry" or "chemistry beyond the molecule" to high-school students. Supramolecular chemistry is distinguished from molecular chemistry by the lack of covalent bonding interactions between the molecular species. Nature is itself made up of supramolecular complexes. For example, deoxyribonucleic acid (DNA) is composed of two strands of which self-assemble through a number of supramolecular interactions (such as hydrogen-bonding and pi-pi stacking) to form the famous Double Helix. This demonstration illustrates a key example of supramolecular chemistry at work: The host-guest complexation.

5. Oxidation/Reduction Reactions

Objectives of the Demonstration: The purpose of this demonstration is to show some of the breadth and utility of oxidation-reduction reactions, as well as to reinforce what might be conceptually familiar material to the high school students. The reduction of silver nitrate (Ag^+) to solid silver to coat a glass surface is a useful process that was traditionally used in industry to make mirrors.

Part 2: Field Trip

For the field trip, each student will pick one of several areas of the department that they are interested in, and will prepare a short presentation/demonstration for that area. The students will be taken from one area to the next. At the end of the field trip, there will be time to discuss college and answer questions about applications, etc. for the students. Additionally, several students will be needed to give a campus tour at the beginning of the field trip.

Tour Stations:

Organic Synthesis Lab: Stern 5019

Ryan Vik will help you discuss some of what goes on in a synthetic organic lab; you will work with him to do several quick demonstration involving the combustion of sugars in a pure-oxygen environment.

Photochemistry Lab: Stern 5037

Photochemistry involves the use of molecules that can both absorb and release energy in the form of different wavelengths of light. It has utility in a variety of areas, from photo-voltaic cells in alternative energy to imaging in biological systems.

Tod Grusenmeyer will help you discuss some of what goes on in our departments' photochemistry labs; you can work with him to do a quick demonstration.

Laser Lab(s): Stern 5073

Lasers (Light Amplification by Stimulated Emission of Radiation) are useful in many areas of science due to their ability to focus large amounts of energy on small areas in a very short time. They are used to analyze reactions and products, as well as to "jump-start" reactions and other physical processes.

Shane McGlynn will help you discuss some of what goes on in our departments laser labs; you can work with him to come up with some quick demonstrations of the power of lasers.

Nuclear Magnetic Resonance Lab: Stern 5003

Nuclear Magnetic Resonance is one of the fundamental techniques used to probe the structure of organic molecules, as well as smaller biomolecules. When the nucleus of an atom spins, it creates a magnetic field. In the presence of an external magnetic field, such as that found within an NMR, the atoms must align either with or directly against this magnetic field. The difference between these two states is small (in the radiofrequency (RF) range) and is dependent on the "chemical environment" of the nuclei- if a more electronegative atom is directly adjacent to a nucleus, it will have a different effect than one that is less electronegative, for example. NMR works by plotting the amount of RF energy that it takes to "flip" each of a particular type of nucleus within a molecule.

Emily Schmidt will help you discuss NMR techniques, along with a quick demonstration.

MALDI-TOF Lab: Stern 4th Floor

MALDI-TOF (Matrix Assisted Laser Desorption-Ionization Time of Flight) Mass Spectrometry is one of the leading techniques in the analysis of macromolecules- proteins, DNA, polymers, etc. Mass Spectrometry techniques work by examining the behavior of the molecules in a sample after they have been ionized- different sized charged molecules will travel differently. In Time of Flight Mass Spectrometry, charged molecules are accelerated by electrical grids, and then allowed to drift to the detector. Smaller charged molecules will travel faster than larger molecules, and the exact mass can be determined by the time the molecule takes to travel (fly) from the grid to the detector. MALDI-TOF uses a high powered laser to ionize the target molecules, but instead of directly targeting the molecules, it transfers energy from to the molecules through a matrix in which the molecules of interest are suspended. This prevents the molecules from fragmenting in response to the high energy laser.

Joe Giesen will help you discuss the MALDI-TOF techniques, along with a quick demonstration.