Hello Organic Chemistry Professors!

The following is a compilation of some of the most popular demonstrations we offer for organic chemistry courses. We hope this can serve as a guide for the semester and are currently working on some projects to better bring the mechanisms of the 2520 classes to life!

For our **2310/2510 classes**, you may find our large models (cyclohexane configurations, chirality, etc.) to be particularly helpful for establishing the basics, as well as our limonene demonstration of chirality and light (my personal favorite).

For our **2520/1920 classes,** we have several options which show how the mechanistic concepts are utilized in real life (polymerization, breathalyzers, etc.).

To order for Autumn 2024, Please click here :)

or scan the QR Code:

As always, early orders are very appreciated, and we can make more models than the ones explicitly stated on the website!

Demonstrations:

Structural Models

Empirical Formulas from Analyses

a) Show ball-and-stick models to match empirical and molecular formulas derived in lecture:
i) C6H6 and/or C2H2 from CH
ii) Any cycloalkane or alkene from CH2.

Representations of Orbitals

a) Show models of s, p, d, and f orbitals

b) Show large Styrofoam balls in two sizes to represent the 1s and 2s orbitals and a large
Styrofoam model of the 2p subshell

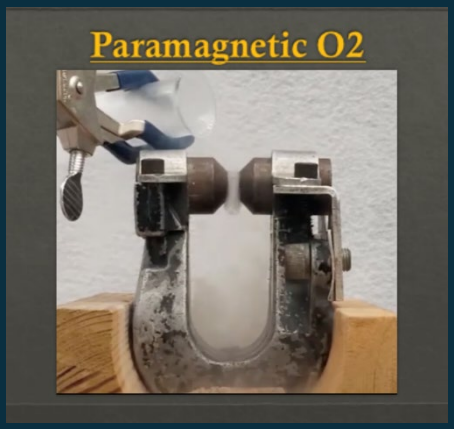
c) Show a large Styrofoam model of the 2s and 2p orbitals nestled together in contrasting colors

d) Show a Styrofoam hemisphere painted to represent a cross-sectional view of the probability distribution of electron density inside a 2s orbital

Molecular Orbital Theory

a) To help students visualize how p orbitals interact to form molecular orbitals, use a large Styrofoam model of the p subshell and a large Styrofoam model of a p orbital (show two p orbitals end-to-end and then two parallel p orbitals along the y axis or the z axis), or use two
small models (side-by-side) of the p subshell (px, py, and pz)
b) Contrast models of NH2—NH2, NH=NH, and N≡N to show the decreasing N–N bond length as the bond order increases.

c) Paramagnetic O 2 – Demonstrate the paramagnetism of liquid oxygen by pouring first N2(ℓ), then O 2(ℓ) between the poles of a powerful magnet displayed by the document camera.



Newman Projections

Use the Newman projection device to show eclipsed and staggered views of a simple alkane.

Cycloalkanes

a) Show Darling models of cyclopropane, cyclobutene, cyclopentane, and cyclohexane

b) Display one (or two) extra-large Darling model of cyclohexane and

define the terms axial and equatorial

c) Show two models of cyclohexane to contrast the chair and boat conformations

d) Pass around Darling models of cyclohexane so students can appreciate its unique structure and contrast the chair and boat conformations for themselves.

e) Add colored substituents to two models of a cycloalkane to show cis and trans isomers.

Organic Chemical Reactions

Polymeric Solids

a) Disappearing Styrofoam Cup – Make a Styrofoam (expanded polystyrene) cup disappear by placing it in a dish of acetone.

b) Nylon 6-10 – Demonstrate the polymerization of hexamethylenediamine with sebacoyl chloride to produce the polyamide Nylon 6-10.

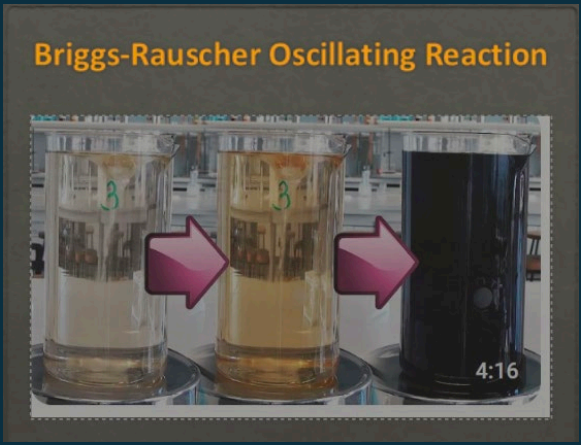
Cross-linking Polymers

a) Disposable Diaper Demo – See how much water you can add to a super-absorbent disposable diaper, then cut open another diaper to show the super-absorbent powder, Water Lock J-550, which is polysodium acrylate cross-linked with starch, the original polymer results from multiple addition reactions of the alkene functional groups of acrylic.
acid molecules. (One diaper holds 1 L of water!)

b) Slime! – make a cross-linked gel by mixing solutions of polyvinyl alcohol and borax; use this demo to relate concepts such as polymers and hydrogen-bonding to commercial product students are familiar with.

Reaction Mechanisms

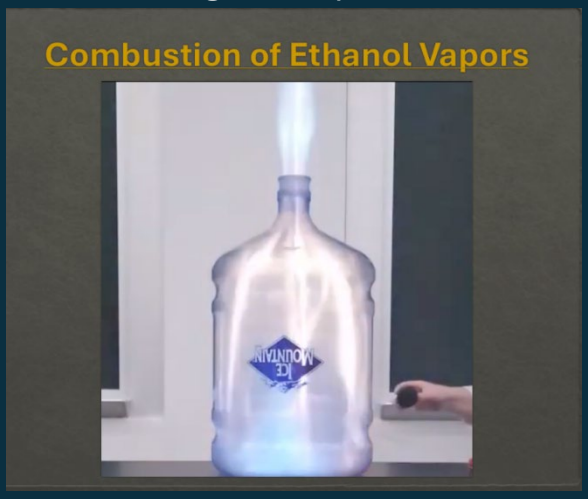
a) Briggs-Rauscher Oscillating Reaction – Introduce the mystery of mechanisms with the Briggs-Rauscher Oscillating Reaction.



b) A Simple Oscillating Reaction – Based on the B-Z oscillating reaction, solutes are added in sequence to produce a red-colorless oscillating reaction. This is an alternative to the Briggs-Rauscher reaction, as it does not produce iodine.

Oxidation of Alcohols – Demonstrate the oxidation of ethanol with $K_2Cr_2O_7$ on the overhead projector; the alcohol solution changes from orange to green to blue as the Cr(VI) is reduced; this reaction is the basis for the Breathalyzer test.

Combustion of Ethanol Vapors – Allow a small amount of ethanol to vaporize in a large carboy, pour out the excess liquid, and hold a lighted splint to the mouth of the container. – the impressive reaction also demonstrates the flammability of organic vapors.



Oxidation and Reduction of Aldehydes and Ketones

i) Tollen's Test: Silver Mirror – Create a silver coating inside a small Erlenmeyer flask using Tollen's reagent and an aldehyde solution.

ii) Benedict's Test – Use Benedict's solution and dextrose to demonstrate Benedict's test for aldehydes. Different sugars are available upon request.

Chirality (models and chemicals)

Optical isomerism

i) Show pairs of MA 2B 2 or MA 3 enantiomers, where A is bidentate; use a large mirror with the models to help explain the concept of non-superimposable mirror images.

ii) Polarizing Filters and Limonene – Place small beakers of (R)-(+)-limonene and (S)-(-)-limonene between two polaroid sheets on the overhead projector to show the equal but opposite rotation of plane-polarized light by these enantiomers; you can also show that a racemic mixture does not rotate polarized light.

Molecular Chirality

(1) Use a large mirror and a pair of enantiomeric models (R- and S-CHBrClF) to explain the concept of non-superimposable mirror images.

(2) Show two models of CH4, two models of CH3Cl, two models of CH2Cl2, two models of CH2ClBr, and an enantiomeric pair of CHBrClF models to contrast superimposable. and nonsuperimposable mirror images; you can also point out the planes of symmetry that exists in all the models except CHBrClF.

Properties of Enantiomers

i) Pass scent samples of (S)-(+)-carvone (odor of caraway) and (R)-(-)-carvone (odor of spearmint) around the class so students can experience the dramatic difference in the odors of these enantiomers.

We will send this out again in a few weeks as a reminder. Additionally, there will be another one for the fall. We are hoping to integrate the demo lab better with the organic chemistry curriculum here, so all suggestions are welcome!