

# Chemistry Demonstrations at JMU

Casey E. Rogers and Kevin L. Caran

Department of Chemistry and Biochemistry, James Madison University MSC 4501

Harrisonburg, VA 22807



## Abstract

All novel and established chemistry demonstrations within the JMU Chemistry Department were organized into handouts, which give instructions on how to do each demonstration. Lesson plans and problem sets were also developed for selected demonstrations to increase the appeal of doing demonstrations in the classroom. The handouts, lesson plans, problem sets, and an appendix were compiled into a handbook. The handbook was formatted into a demonstration website for ease of access in the department as well as externally. Internally, "Demo Kits" were assembled to provide instructors with the ability to easily perform a demonstration in class without the hassle of preparing and gathering the materials. A demonstration workshop was held for 12 high school teachers as a way to positively impact communities beyond JMU.

A website was developed for use within and beyond the Department. The website contains a "Demo Database" which provides information on how to do over 40 demonstrations including which Virginia SOLs that correspond with each demo.

**Demos**

At JMU we have a long standing tradition of demonstrations. Our student organizations, ALC (Alpha Chi Sigma) and SAAC'S (Student Affiliates of the American Chemical Society), use demonstrations to perform magic shows for children or help scouts to gain science badges. Demos are a great way to get children interested in science and provide a great way to visualize chemical concepts. Recently, there has been an effort in the department to incorporate demos into lectures to help students visualize and understand what they are learning.

*"The soul never thinks without an image."*  
- Aristotle

**Demo Database**

Demo Title	Description	Topics Covered	SOLs Covered
Acid base Interactions	Litmus paper turns red in acidic substances and blue in basic ones. This activity allows students to explore what substances are acidic and which are basic.	acids and bases	• PS.2b • CH.1b
Aluminum Foil and NaOH	This demo simulates what happens when Drano is poured down a clogged drain; the hydrogen gas produced forces grunk out of the drain. $2\text{Al} + 2\text{NaOH} + 6\text{H}_2\text{O} \rightarrow 2\text{NaAl(OH)}_4 + 3\text{H}_2$	• complex ion reactions • redox • exothermic reactions	• PS.4 • CH.2b • CH.4b
Ammonium Nitrate Reaction	When ammonium nitrate is dissolved in water it feels cold, which indicates an endothermic reaction. $\text{NH}_4\text{NO}_3(\text{s}) \rightarrow \text{NH}_4^+(\text{aq}) + \text{NO}_3^-(\text{aq})$	• endothermic reactions	• CH.3c • PH.8a
Bending Water	This demo uses a charged balloon to bend a stream of water.	• polarity	• 6.5a • CH.2a
Black Foam	When sugar is reacted with concentrated sulfuric acid it creates a black foam made of elemental carbon. The water that is produced in the reaction is gaseous and causes the foam to rise. $\text{H}_2\text{SO}_4 + \text{C}_{12}\text{H}_{22}\text{O}_{11} \rightarrow 12\text{C} + 11\text{H}_2\text{O} + \text{a mixture of acid and water}$	• organic reactions • redox	• CH.3b • CH.4b

<http://csma31.csm.jmu.edu/chemistry/faculty/caran/research/outreach/index.htm>

## Future Work

- develop additional **lesson plans** and **problem sets** for the demonstrations
- strengthen relationships with K-12 teachers
- **Demonstration Workshops**
  - full day workshop
  - provide more opportunities for teachers to interact with each other
- **strengthen safety information**
- expand the number of **demo kits**
- develop a **demo show** to be performed locally
- continue to improve and expand the **website**
- explore the possibilities of creating a **service learning course** at JMU on demonstrations



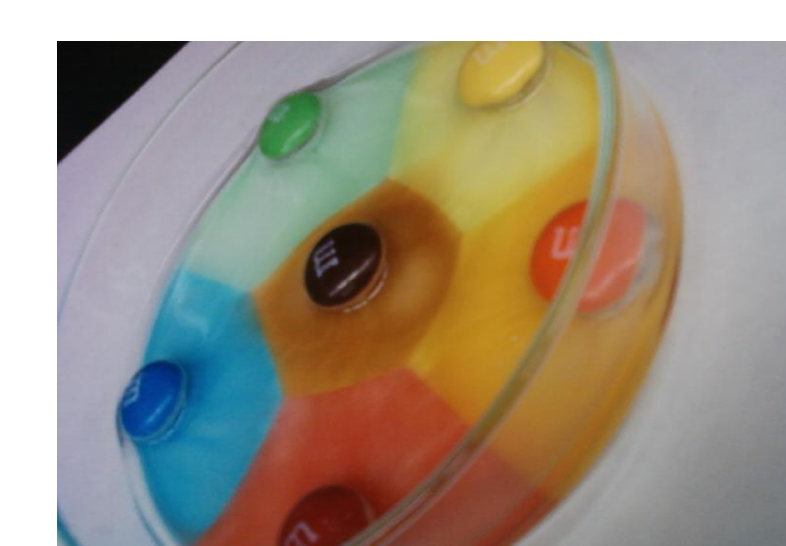
Colored Flames



"Demo Kits" were assembled for instructors to take to lecture. The kits include everything needed to perform a demonstration. These have been popular among General Science course instructors, and by student organizations for doing demos in schools.

## Demonstration Workshop

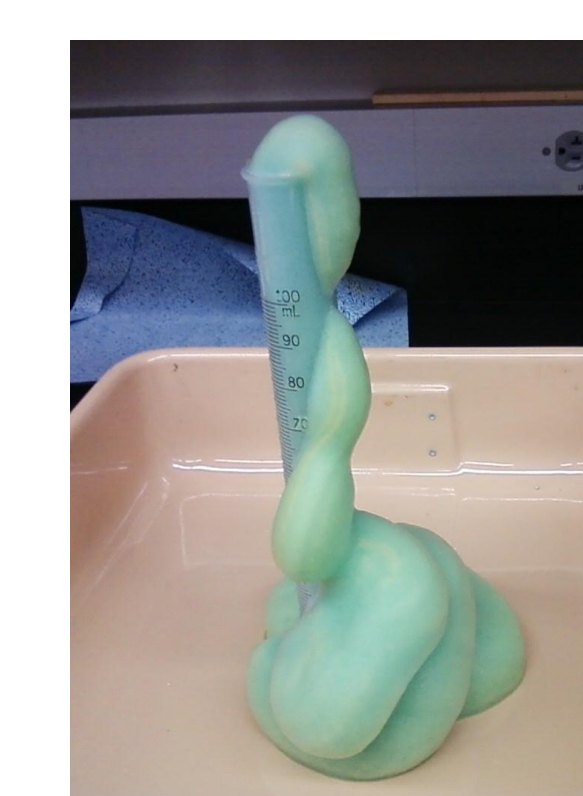
A demonstration workshop for high school science teachers was held in Summer 2010 where they learned hands on how to do 12 demonstrations. The teachers discussed amongst themselves and shared ideas.



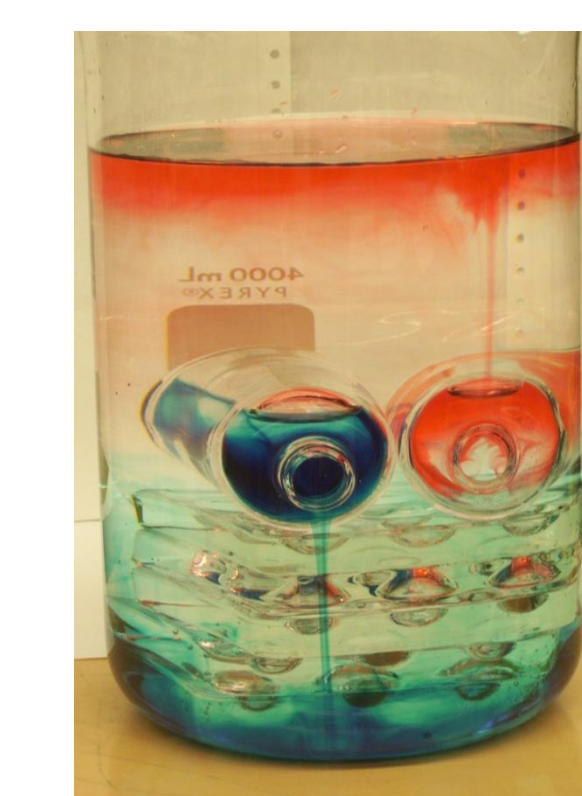
M&M Color Wheel



Dry Ice in Universal Indicator



Elephant's Toothpaste



Hot-Cold Water

## Freshman Outreach

On February 4, 2010 and March 3, 2011 Casey taught the freshman chemistry majors how to do demonstrations in their lab class. This was an attempt to get the freshman more involved with the outreach, more interested in the student organizations, and more involved in department life.

## Acknowledgments

- Tickle Summer Research Scholarship
- Research Corporation for Scientific Advancement, Departmental Development Award 7957
- Dr. James P. Wightman (professor emeritus, VT Chemistry)
- Dr. Bassam Shkhashiri (professor, UW-Madison Chemistry)

RESEARCH CORPORATION  
for SCIENCE ADVANCEMENT

