

Behind the Scenes with Chemistry

An Educational Hands-On Demonstration Package

**Prepared by the
National Chemistry Week Committee
of the
Cleveland Section of the American Chemical Society
for
National Chemistry Week 2010**

Overview

This year our hands-on demonstration program explores the chemistry “behind the scenes”. We will “walk” onto a movie set, and show how science concepts can explain the “magic” of special effects. We will help design a scene by making artificial snow, a levitating monster, and a spooky monster face (just in time for Halloween too), and in the process learn about chemical changes, physical properties and other science concepts like magnetism and polymers.

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Acknowledgments

The National Chemistry Week (NCW) programs of the Cleveland Section ACS began in 1994 with an idea to put together a scripted program that could be performed at any local school or library. This idea has expanded to become the centerpiece of the Cleveland Section's NCW activities; it has received national recognition from the American Chemical Society. In 2010, the Cleveland Section volunteers will perform over 40 demonstrations at libraries, schools, and other public sites. Continuing our relationship that started in 2001, the Cleveland Section will also be providing hands-on training and (at least) 50 sets of materials for Cleveland-area teachers, at the Cleveland Regional Council of Science Teachers' (CRCST) Fall Conference, so that they can conduct additional programs in their own classrooms.

Our NCW efforts reach many students each year because of various sponsors who have donated money, materials, and/or services to the Cleveland Section specifically for National Chemistry Week. We are especially grateful to the Martha Holden Jennings Foundation for a significant financial grant this year of \$3000, to the GrafTech Corporation for its gracious donation and to the Cleveland Section for its continuing support. We would also like to thank John Carroll University, Cuyahoga County Public Libraries, NASA Glenn Research Center, and other anonymous sponsors for their numerous contributions and support.

Last and most important, we thank all the volunteers who donated their time and expertise. This library/school program and other NCW events are the result of the hard work of many dedicated and talented volunteers. It all starts with our local section NCW Planning Committee. The Committee develops a theme for the program; recommends, tests, and reviews activities & experiments; writes a script; collects supplies and materials; prepares the kits; recruits sponsors and volunteers; contacts libraries and schools; and schedules shows. This Committee, as well as the rest of the Section's NCW activities, was overseen by the Cleveland Section's NCW co-coordinators for 2010 Bob Fowler and Kat Wollyung. Committee members include Lois Kuhns, Marcia Schiele, Natalie Zarlenga, Vince Opaskar, Margaret Pafford, Shermila Singham, Mark Waner, Don Boos and Betty Dabrowski. Additional credit and thanks is given to the many GAK Day (Grand Assembly of Kits Day) volunteers (including local university students) who donated their time beforehand or gave up a Saturday in September to help count, measure, and assemble all of the necessary materials for our demonstration kits. A final thank you goes out to the dozens of dedicated chemical professionals who lead the presentations and activities in schools, libraries, and other public locations; without them there would be no Cleveland Section NCW program.

Story Line

This year we follow our friends Milli and Avogadro who have had the lucky opportunity to travel to a movie filming. They have gone behind the scenes to find out just what goes into the mystery and magic of special effects, and they have found out that quite a bit has to do with science and chemistry.

First they are exposed to the curiosity of artificial snow and then see a floating monster! They get to follow the 'monster' to his dressing room and investigate how other 'monsters' are in the process of using chemistry to put on some pretty scary monster faces.

How Experiment Write-ups are Organized

The materials and set-up of the demonstrations are located in the introduction section of this packet. Then, each experiment's write-up is presented as follows:

- Experiment Purpose & General Methodology
- Introduce the Experiment
- Performance Details
- Conclusions
- Additional Information if Needed: Technical Information
- Any additional information for the teachers who receive this kit

Each presenter obviously does not need to cover all of this material with the students. Some is only for the adult/parent audience. Pick out what you are comfortable explaining.

Presentation Overview

This section describes the basic presentation technique used during the demonstrations. This is a guideline only as the technique may vary for some experiments. Make sure you follow the instructions given in each experiment.

- The program this year consists of 7 experiments.
 - For most experiments your demonstration and the student's hands-on work are nearly simultaneous. You will lead them as they perform the experiment.
 - Five experiments will be done by all students. For the other two (Exps. 1 & 2), there will be one experiment that will be shared by all or some of the students at the table; please encourage multiple students to assist when an experiment is done as a group at a table.
- At the end of the day the students will NOT be able to take home the monster face that they created but they will each be given the Celebrating Chemistry newspaper, our hand-out sheet with directions for making a monster face at home and a small gift (a fuzzy weeble monster) to remember the program and tell all their friends.

VOLUNTEERS

The NCW Committee will offer a "Dress Rehearsal" on Saturday, Oct. 2, 2010 to show the entire program to the presenters in advance of their own program performances; however, attendance is not mandatory. This script provides enough detail for a competent adult to be able to perform the presentation. The Cleveland ACS and NCW Committee do not require background checks on its volunteers nor do we require formal educational/teaching experience from all of its volunteers.

MAKE SURE TO FOLLOW ALL DIRECTIONS IN EXPERIMENTS

If experiments have special safety concerns due to the materials being used, they will be listed in the section for that experiment. For this year's program, eye protection should be worn at all times and students should be specifically told to not touch their eyes; if exposure should occur, flush with water and report the incident to the librarian and parent. The low concentrations of our chemical solutions make them irritants. For skin contact, washing with soap and water will suffice; any coloration of the skin is temporary and will wash/wear off.

Websites for where to obtain a Material Safety Data Sheet (MSDS) are listed in the appendix and are found on our website.

SAFETY NOTE:

The solution "P" in Experiment 4 contains denatured ethyl alcohol. In significant amounts, ethyl alcohol (also known as ethanol or liquor) can be toxic by ingestion and inhalation and irritating to body tissues. Tell students to NOT inhale the fumes from the solution as much as possible and to avoid all body tissue contact as it can be irritating and harmful to their health. Should the solution spill during the presentation, move the students from the table with the spill until you have removed all the wet newspaper, placed them in a trash bag and sealed the bag.

Each table has a cup containing about 8 ml or 1.5 teaspoons total solution which is not a "significant" amount but we felt this notice was important for those not familiar with alcohol solutions.

For information about the American Chemical Society's NCW safety guidelines, visit www.acs.org/portal/Chemistry?PID=acsdisplay.html&DOC=ncw%5C%2Fsafetyguidelines.html

Cleveland Section ACS "National Chemistry Week" website:

http://www.csuohio.edu/sciences/dept/cleveland_acs/NCW/

National American Chemical Society's "National Chemistry Week" website:

www.acs.org/ncw

Demonstration Check-Off List

Activities To Do Well Before the Day of the Demonstration	Completed?
<p>Contact your library and</p> <ul style="list-style-type: none"> ➤ Verify the date and time of your 1-hour program ➤ Also schedule AT LEAST a half-hour before and a half-hour after your program for set-up and clean-up. We recommend an HOUR of set-up, depending on how familiar you are with the materials in your kit and if you will have an assistant. 	<input type="checkbox"/>
<p>Plan to attend the Dress Rehearsal -where the NCW Planning Committee will demonstrate each experiment. Go to our website (ref. page 4) for details.</p>	<input type="checkbox"/>
<p>Read through this packet to familiarize yourself with the experiments and verify that you have all the items as listed in the kit contents.</p>	<input type="checkbox"/>
<p>If you're using a pre-printed hard copy of the script, obtain the Script Errata/Addendum Sheet (usually issued just AFTER the Dress Rehearsal). Go to our website (ref. page 4) for details.</p>	<input type="checkbox"/>
<p><i>Please check your kits upon receiving them.</i> Vials and bottles containing solutions may have shifted during storage and transportation. Check for leakage; correct situations. Store vials and bottles in as upright a position as possible.</p>	<input type="checkbox"/>
<p><i>Please do not store kits in an overly warm area</i> (such as in a car on a hot day). The kit contains many vials and bottles containing solutions that may leak under pressure created by higher temperatures.</p>	<input type="checkbox"/>
<p>Contact us with any questions: Bob Fowler at fowler@en.com or Kat Wollyung at acs.ncw.kat@gmail.com.</p>	<input type="checkbox"/>
<p>Collect the materials you need to bring with you to the demonstration. This materials list is on page 10. The librarian may be able to provide some of the items, but you need to call to verify that – do not assume they have anything.</p>	<input type="checkbox"/>
<p>While not necessary, you may choose to ask a friend and/or contact the children's librarian well in advance and request a student assistant or librarian to be your assistant. Having someone available to help set-up the room before the program and collect trash as the program progresses can help keep supplies organized. That person can also assist if multiple students need assistance or have questions about the experiments.</p>	<input type="checkbox"/>
<p>If you wish to add other experiments or demonstrations into your program, you must contact the Head Children's Librarian through your local librarian ahead of</p>	<input type="checkbox"/>

time to get approval. Be careful and think "safety first". Neither the NCW Committee nor the Cleveland ACS approves of any experiments added to your program, and you are responsible for your own actions.	<input type="checkbox"/>
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Activity To Do about ONE WEEK BEFORE your program	
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If you're using a pre-printed hard copy of the script, obtain the Script Errata/Addendum Sheet (usually issued just AFTER the Dress Rehearsal). Go to our website (ref. page 4) for details.	<input type="checkbox"/>
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<p>Contact the children's librarian who is helping you to coordinate our program:</p> <ul style="list-style-type: none"> ➤ VERIFY that they limited registration to 25 students. ➤ Ask the room to be arranged with 5 student tables with 5 chairs each, an additional front table for the presenter and a small side table/area for literature, photo permission forms, and goggles. ➤ Ask for all the experiment tables to be covered with newspapers and for extra paper towels for each table. Otherwise take newspaper and do this during setup. ➤ Ask about availability of demonstration materials from list of page 10 (ex. paper towels, newspaper) ➤ Ask if the librarian and/or an assistant will be available to assist with the program or inform them if you will also be bringing an assistant. ➤ Make sure that the room is available before and after the program for set up and clean up. Set-up will take approximately 1 hour on your own. When you call the librarian, <u>make sure that the room will be available and that you can access it 1 hour before the start time</u>. If the librarian and/or that friend/student assistant are available to help with set-up, this will cut down the time. <p>Offer that a librarian and/or student assistant are welcome and encouraged to stay for the entire program. (They might even offer to be an assistant if given the opportunity.)</p>	<input type="checkbox"/>
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Activity To Do AT LEAST ONE DAY BEFORE the Demonstration	Completed?
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Read over the experiments a few times and become familiar with them. Our program is designed for one-hour, but this assumes you are familiar with the program and are not strictly relying on reading the script step by step on site.	<input type="checkbox"/>
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Gather all the items needed for your presentation as provided in the materials list starting on page 10. Do NOT assume your librarian will supply any materials unless agreed upon in advance, and even then, call and verify he/she remembered your requests. Do NOT assume you can easily obtain water in the library; at some sites, faucets are close to the sink bottom and allow little room for easily filling bottles or cups.	<input type="checkbox"/>
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Activities To Do When You Get To The Library	Completed?
NOTE: Arrive at least 1-1/2 hours before show time to allow for introductions and set-up depending on how quickly you think you can perform the steps listed in the Experimental Setup section. DO NOT assume that a librarian will be present to help you set up for the experiments.	<input type="checkbox"/>
Introduce yourself to the Children's librarian.	<input type="checkbox"/>
Confirm that the tables and chairs are set up properly.	<input type="checkbox"/>
Confirm that all tables are covered in newspaper and have paper towels.	<input type="checkbox"/>
Obtain those supplies from the list on page 10 if provided by library.	<input type="checkbox"/>
Optional: Ask the Children's Librarian or an assistant to take pictures during the demonstration (subject to parents'/guardians' having given permission).	<input type="checkbox"/>
Complete Demonstration Set-Up. See Experimental Set-Up: "Activities to Do On-Site Prior to Demonstration" starting on page 14. <i>Note: This set-up is estimated to take 60 -90 minutes by one person.</i>	<input type="checkbox"/>
Set-up note! If you follow the script as originally written, there are many cups and other items on the tables. Depending on the size of your tables, and the activity level of your students, you may choose to distribute fewer items originally. If so, then perhaps keep the remaining experiments' material at your presenter's table—on a tray if you have one—and distribute these items throughout the program.	<input type="checkbox"/>
Set-up note! There are few solutions which are irritating to the skin in this year's program: phenolphthalein solution, KSCN, FeCl ₃ and K ₄ Fe(CN) ₆ ·3H ₂ O. For the corresponding MSDS sheets please see the links listed in the appendix or on our website at http://www.csuohio.edu/sciences/dept/cleveland_acs/NCW/ . Flushing skin and eyes with water should suffice, but seek medical attention if needed/desired.	<input type="checkbox"/>
Set up an 'Entrance' area table to allow space for goggle distribution and fitting by the parents, photo permission form signing, and (at the end of the program) distribution of literature .	<input type="checkbox"/>
You may wish to set up an 'Exit' area table to allow space for end-of-program activities: goggle return and literature distribution.	<input type="checkbox"/>

Information and Checklists

Presenter's Guide

Activities To Do At the Start of The Demonstration	Timing
Ask the parent/guardian for permission to photograph the children for possible use on our website and obtain their signatures to this effect . (If that permission is not obtained, make sure that that student is positioned in such a way in the room that they won't be included in the photographs, or do not take any photographs.	<input type="checkbox"/>
Hand out goggles and help adjust to the correct fit (if necessary).	<input type="checkbox"/>
Assess number of students per table and adjust to 3-5 per table. Record the number of students and adults on the provided Demo Feedback form. Do not allow any student to sit alone at a table as some experiments require two people to perform.	<input type="checkbox"/>

Activities To Do During The Demonstration	Timing
Perform demonstrations	
➤ Welcome	7 min
➤ Experiment 1: Fake Snow (polymer swelling; physical change)	4 min.
➤ Experiment 2: Levitation (magnetism)	3 min.
➤ Experiment 3: Monster's Foaming Mouth – Part 1: Setup (gas producing chemical reaction; acid-base reaction)	3 min.
➤ Experiment 4: Monster's Hair – Part 1: Setup (indicators)	2 min.
➤ Experiment 5: Monster's Skin/Scar (polymers; measuring)	12 min.
➤ Experiment 6: Monster's Blood (color changing chemical reactions)	4 min.
➤ Completion of Experiment 4: Monster's Hair	2 min.
➤ Experiment 7: Monster's Blue Face (color changing chemical reactions)	5 min.
➤ Completion of Experiment 3: Monster's Foaming Mouth	1 min
➤ Complete the Closing Session information.	2 min.
➤ Collect goggles & hand out literature & say "Thanks for coming" . Allow students to take home items as mentioned in the Closing Session on page 39. Be aware to not show favoritism by giving out items that you cannot give to all students.	2 min.
Note: Times are approximate. Be familiar with the experiments before you arrive so you do not waste time 'reading' the script. You may choose to omit an experiment so that your program does not run over time, or change an experiment from hands-on to a demonstration. <u>Plan ahead</u> to determine which experiment you might skip over or abbreviate.	<i>Total Time: ~ 60 min</i>

Information and Checklists

Presenter's Guide

Activities To Do Immediately After The Demonstration	Completed?
Clean up as indicated in the Clean Up section (page 40).	<input type="checkbox"/>
Complete the Feedback Form. Put it and any completed Photo Permission forms in the manila envelope provided and return them to <i>Julia Boxler YTH</i> via the library's mail system along with the goggles.	<input type="checkbox"/>
Give the mailing envelope(s) (including the reusable items, the feedback form and the photo permission forms) along with the box of student and adult goggles to the librarian for return to Julia Boxler via interlibrary mail. <i>(Those outside of the CCPL network can return items to your nearest CCPL branch for return to Julia Boxler-YTH. See www.cuyahogalibrary.org for branch listings.)</i> Please return all materials within two weeks of NCW.	<input type="checkbox"/>
Give any leftover literature to the librarian <i>(CCPL library kits only)</i> .	<input type="checkbox"/>

Activities To Do Once You Get Home	Completed?
If you didn't complete a Feedback form and return it via the inter-library mail, we still need feedback about your program. The feedback form is available on our website. Please complete the form electronically and then submit it to Bob Fowler @ fowler@en.com . This information may be useful to other presenters who have not yet performed their 2010 presentation. It will also be used to justify our expenses for funding of future programs.	<input type="checkbox"/>
Smile! You have just shared your joy of science and chemistry with children, possibly inspiring them to become great scientists, chemists, biologists	☺

Supplies Required for Demonstration

Items for Presenter to Provide (or to request in advance from the librarian — do not assume that the library will have these materials)

1. newspapers for covering 6 long tables with a few layers of paper (if none at site)
2. 1 large garbage bag for solid waste collection
3. 1 bucket for liquid waste collection (optional if sink is within the demo room)
4. A pen (for filling in forms)
5. scotch or masking tape (for taping paper bags to sides of tables)
6. 1 teaspoon
7. 1 roll of paper towels (several of the experiments have paper towels included, but it's a good idea to have extra).
8. Small plastic tray(s) for arranging plastic cups on, filling same and then distributing.
9. 1.5 cups water (Exp. 1). It's a good idea to bring an extra gallon of water (Note: It may be difficult to transport water from library restrooms with shallow sinks or fountains with low spigots, so do NOT plan to use this method to obtain water unless you have investigated the water availability at your site.)

Optional: IF you care to take pictures, bring a digital camera for taking photos. Make sure students' parents have given their permission for the children to be photographed on the ACS form and that the students and adults to be photographed are all wearing goggles. You might want to assign the photography chores to an assistant during the demonstration.

Note: If you will be performing multiple demonstrations on the same day, you will need to sanitize the goggles between demonstrations. You will also need:

1. small quantity of household bleach
2. wash bin or bucket
3. old towels or cotton paper towels for drying (soft so as not to scratch the goggles)

...OR...

4. individual sanitizer wipes (soft so as not to scratch the goggles)

Items Provided in Each Demonstration Kit:

General

1. 1 kit box containing materials for 7 Experiments and literature for distribution:
 - a. 25-27 copies Celebrating Chemistry newspapers
 - b. 2-3 copies of ChemMatters magazines for older siblings/friends of the students (if available from ACS)
 - c. 25 copies each of the two-sided "Book & Website List"/"Experiments to do at Home" handout
 - d. 1 Program Feedback Form (designed for either teacher programs or library programs)
 - e. 25 copies of the ACS photo permission form. (Library Kits only)
 - f. 2 large manila envelopes for returning the Feedback and Photo Permission Forms and reusable supplies to the NCW via interlibrary mail (addressed to Julia Boxler - YTH) (library kits only)
 - g. One bag of 25 gifts (weeble monsters)

NOTE: Initially, the return envelope will contain much of the paperwork for your program. This was done to help prevent folding and wrinkling in storage/transport.

2. 1 box of goggles (25-30 student & 2 adult size, addressed for return to Julia Boxler - YTH) (library kits only)

Materials by Experiment

Sign-In

None for 2010

Experiment 1: Fake Snow (Group Experiment)

- 1) Steve Spangler Insta-snow™ powder (6 tsp.) in the baggie marked "S".
- 2) 6 paper plates
- 3) 6 paper towels
- 4) 6 (3-oz) plastic cups with a mark at the volume of ¼ cup marked "W".
- 5) 6 (3-oz) unmarked plastic cups marked "S".
- 6) water (from library or your own supply, room temp/warm is fine) approximately 1 ½ cups

Experiment 2: Levitation (Group Experiment)

- 1) 6 pom-pom monsters
- 2) 6 glue dots
- 3) 12 ceramic ring magnets 0.75" ID x 0.25" OD x 0.25" thickness
- 4) 6 bendable drinking straws with ID not more than 0.25"

Experiment 3: Monster's Foaming Mouth (Individual Experiment)

- 1) 26 Q tips
- 2) 26 paper towels
- 3) 26 (4 oz) plastic cups marked "B"
- 4) 6 (4 oz) plastic cups marked "V"
- 5) 6 (4 oz) plastic cups marked "G"
- 6) 26 1ml beral pipettes
- 7) 26 large (9") paper plates
- 8) 26 small (6") paper plates
- 9) 1 50ml vial containing white vinegar inside a sandwich bag marked "V"
- 10) 1 sandwich bag marked "B" containing baking soda
- 11) 26 small pencils
- 12) 1 (4oz) bottle of Elmer's glue.
- 13) 6 white index card halves (to cover cups and reduce vinegar odor before use)

Experiment 4: Monster's Hair (Individual Experiment)

- 1) 52 Q-tips
- 2) 6 (2 oz) plastic portion cups marked "P"
- 3) 6 (2 oz) plastic portion cups marked "A"
- 4) 1 50ml self-standing vial marked "P" containing 50ml of 1% phenolphthalein solution (in ethyl alcohol)
- 5) 1 50ml self-standing vial marked "A" containing 50 ml of clear household ammonia.
- 6) 6 white index card halves (to cover the ammonia solution once it is poured)
- 7) 6 brown paper lunch bags

Experiment 5: Monster's Skin (Individual Experiment)

- 1) 1 baggie marked "J" containing gelatin
- 2) 26 plastic spoons
- 3) 1 plastic bottle (16-20 oz size)with approximately 225ml diluted Elmer's glue
- 4) 6 10ml plastic syringes
- 5) 26 (4 oz) plastic cups (marked R)
- 6) 6 (4 oz) plastic cups (marked "DG")
- 7) 26 paper towels
- 8) 26 stirring sticks
- 9) 6 (4 oz) cups marked "J"

Experiment 6: Monster's Blood (Individual Experiment)

- 1) 6 (2 oz) plastic portion cups marked "1"
- 2) 6 (2 oz) plastic portion cups marked "2"
- 3) 1 50ml self-standing vial marked "1" containing 50ml of 0.1M KSCN solution
- 4) 1 50ml self-standing vial marked "2" containing 50 ml of 0.1 M FeCl₃ solution
- 5) 52 beral pipets

Experiment 7: Monster's Blue Face (Individual Experiment)

- 1) 52 Q-tips
- 2) 6 (2 oz) plastic portion cups marked "3"
- 3) 6 (2 oz) plastic portion cups marked "4"
- 4) 1 50ml self-standing vial marked "3" containing the 0.1 M K₄Fe(CN)₆·3H₂O solution
- 5) 1 50ml self-standing vial marked "4" containing the 0.1 M FeCl₃·6H₂O

Activities to Do On-site Prior to Demonstration**General:**

1. Verify room setup. (5 student tables with 5 chairs each, one presenter table, all covered with newspaper, each with paper towels, etc.) One additional table at room entrance.
2. Obtain any supplies requested from librarian (see page 10)
3. On the entry-table place the ACS Photo Permission forms and a pen. IF you plan to take photos during your presentation for NCW/ACS use (on Cleveland NCW ACS website and/or for submission to National ACS for awards or annual reports) you **MUST** obtain a **signed** photo permission form for each and every person in the photo. Do NOT take photos of *anyone* without written approval. Also, everyone in any photo must be wearing goggles.
4. Place goggles where they can easily be distributed.
5. On the entry/exit table place the literature, book/website/take-home handouts and gift bag to be distributed at the end of the program to each child as you collect the goggles.

Experiment 1: Fake Snow (Group Experiment)

Prepare the following items and place at each of the student's and presenter's tables

1. Place paper towel in center of table.
2. Place paper plate on top of towel.
3. Measure out 1 tsp of Insta-snow™ from the baggie marked "S" and place in an empty white 3 oz. cup marked "S".
4. Place 3 oz. cup marked "S" in the middle of each paper plate.
5. Fill marked 3 oz. cups marked "W" to line with water; place next to paper plate

Experiment 2: Levitation (Group Experiment)

At each of the student's and the presenter's tables place:

1. 1 pom-pom monster
2. 1 glue dot
3. 2 magnets
4. 1 bendable straw

Experiment 3: Monster's Foaming Mouth (Individual Experiment)

First do the following:

1. Evenly distribute the vinegar from the 50 mL vial into the 6 cups marked "V". Cover each cup with a half index card to minimize odors.
2. Evenly distribute the contents of the Elmer's glue bottle into the 6 cups marked "G".

3. Place 1 level teaspoon of baking soda from the sandwich bag marked "B" into each cup marked "B".

At each student's place and the presenter's table, put the following:

1. 1 Q tip
2. 1 large 9" paper plate
3. 1 small 6" paper plate
4. 1 1-ml beral pipet
5. 1 paper towel
6. 1 small pencil
7. 1 4-oz plastic cup marked "B" containing the baking soda

At each table including the presenter's, put the following:

1. 1 4-oz plastic cup marked "V" containing the vinegar
2. 1 4-oz plastic cup marked "G" containing the Elmer's glue

On the inside of the small paper plate on your table, draw a face with eyes, nose and accentuated, extra large lips and teeth leaving sufficient room for placing a "scar" later.

Note: If you have a tray available, you might want to place all 12 of these cups on this tray at the presenter's table and distribute them to the tables as needed. This is especially true of the vinegar so that odors and the possibility of the cups tipping over are minimized at each table.

Experiment 4: Monster's Hair (Individual Experiment)

Prepare the following items:

1. Divide the contents of the 50 ml vial marked "P" containing the phenolphthalein solution evenly among the 6 portion cups marked "P." Cover with half an index card. DO NOT PLACE this cup on the student tables until you do the experiment to avoid vapor.
SAFETY NOTE: This solution contains denatured ethyl alcohol. In **significant amounts**, ethyl alcohol can be toxic by ingestion and inhalation and irritating to body tissue. Each table will have a rather limited amount (about 8 ml or 1.5 teaspoons) in their cup. Refer to the safety statement on page 4 and the MSDS if needed.
2. Divide the contents of the 50 ml vial marked "A" containing the household ammonia among another six portion cups marked "A" and immediately cover the cup with the half index card. DO NOT PLACE THESE ON THE STUDENT TABLES UNTIL YOU ARE READY TO DEVELOP THE COLOR LATER IN THE PROGRAM!

At each of the student's and the presenter's tables place the following:

1. 10 Q-tips at the student tables and 2 Q-tips for the presenter
2. Tape one brown paper lunch bag to the center edge of each table (not the newspaper) on the side opposite student chairs. This is for disposal of Q-tips and pipets to prevent contamination during the chemical reactions used in the program for this and following experiments.

Note: If you have a tray available, you might want to place the cups on this tray at the presenter's table and distribute them to the tables as needed.

Experiment 5: Monster's Skin (Individual Experiment)

At the presenter's table do the following:

1. Distribute the gelatin among 6 4-oz plastic cups marked "J"
2. Into the 4 oz cups marked "DG" add approximately 40 ml of the glue solution (to the marked line on the cup.) Add about half that amount for the presenter's cup. Keep this at the presenter's table until you are ready for this experiment.

Note: If you have a tray available, you might want to place the cups on this tray at the presenter's table and distribute them to the tables as needed

At each of the student's places and the presenter's table place put the following:

1. 1 empty 3-oz plastic cup marked "R"
2. 1 stirring stick
3. 1 paper towel
4. 1 plastic spoon

At each of the student's and the presenter's tables place put the following:

1. 1 plastic syringe

Experiment 6: Monster's Blood (Individual Experiment)

At the presenter's table do the following:

1. Distribute the solution in vial "1" equally among the six portion cups marked "1" but do not distribute at this time.
2. Distribute the solution in vial "2" equally among the six portion cups marked "2" but do not distribute at this time.

At each student's place and at the presenter's table put the following:

1. 2 beral pipets

Experiment 7: Monster's Blue Face (Individual Experiment)

At the presenter's table (only) place the following:

1. Distribute the solution in vial "3" equally among the six portion cups marked "3" but do not distribute at this time
2. Distribute the solution in vial "4" equally among the six portion cups marked "4" but do not distribute at this time.

Note: If you have a tray available, you might want to place the cups on this tray at the presenter's table and distribute them to the tables as needed.

At each student's place and the presenter's table place the following:

1. 2 Q-tips. IF YOU PREFER, distribute the Q-tips with the cup "3" at the time of the actual experiment.

Exit Table (may be same as entry table)

1. Set out the literature and bag of gifts for students to pick up at the END of the program
2. Set up an area for goggle drop-off

Greet the Students (and Parents) Upon Their Arrival, Distribute Goggles, and Organize the Seating

- Ask the parents/guardian to give or withhold their permission for the student to be photographed via the ACS consent form. **Don't forget to obtain their signatures on the forms provided.**
- Help or have the parents the students put on their goggles. Adjust the straps as necessary. (Note: These goggles are sanitized each year and prior to each demonstration.)
- Ask each student to PLEASE not touch any of the materials before the program begins. Some experiments may be ruined if they do.
Distribute the students 3-5 per table. (Note: You might want some librarian assistance with this: IF you plan to take photos and some of the parents have denied permission, you'll want to put all of the children who aren't going to be photographed at a separate table.)

Opening Discussion

Introduce the Items on the Tables:

- Tell the students that various items have been gathered for them on their table.
- Some of the items can be found around the house, but others are laboratory chemicals. Emphasize that students should NOT touch anything until instructed to do so. *Never taste or smell anything, as if they were in a laboratory!*
- Tell the students that some of our items today can stain clothes or hands if we're not careful. Mention to mom and dad that the chemicals can be washed off with soap and water if any hands get stained. We will also be good chemists and take the safety precaution of protecting our eyes with our goggles.
- Put on a pair of the adult-sized goggles. If you have an assistant, ask them to do the same. Verify that all students have goggles on.

Introduce Yourself and the Program

- Introduce yourself as a chemist or chemist/science teacher/engineer (or state your interests in chemistry), and introduce the American Chemical Society as the largest organization in the world devoted to a single profession.
- Introduce National Chemistry Week - what it is and why we do it. (*Hint: it is a nationwide event put on by volunteers like you to let non-scientists know about chemistry and how it has improved our everyday life.*)

Introduce Today's Presentation:

- The theme of NCW this year is “Behind the Scenes with Chemistry”. Ask “Have you seen a movie lately? Or watched a TV show? The movies and TV shows want to tell you a story and make it look real. When you watch special affects in movies, how often do you say “Wow, I wonder how they did that!” or even “Is it magic?”
 - You may wish to know about Toy Story, Shrek, Despicable Me, How to Train Your Dragon, Nanny McPhee, The Lightning Thief, Harry Potter and the Fantastic Mr. Fox.
- Do you think everything you see in a movie is real? [*No. Movies want to make fake things look real.*] What are some of your favorite affects? (*Take a minute or so for some brief answers.*)
 - Did you know that if there is ice cream in a movie scene that it might not be real ice cream? It might be a chemical substance called mashed potatoes, because they don't melt under hot camera lights even if the filming takes many hours.
 - Do you think if an actor is crying that those are always real tears? Sometimes they use glycerin, a non-harmful chemical which is clear and drips like real tears.
 - A splash of milk might be a chemical substance called glue which doesn't smell gross if it sits out in the heat for multiple days.
 - Sounds aren't chemistry, but the sounds of bones being broken might be a chemical substance called celery being snapped in two.
- Have you ever watched the part of the movie with extra information concerning how it was made? It's interesting to see how people can make fake things look real. We're going to use chemistry to do just that!
- We are going to pretend to have “walked” onto a movie set along with our chemist friends, Milli and Avogadro. We saw a lot of cool special effects and wondered if they were magic. Milli and Avogadro told us that they can be explained using CHEMISTRY and science concepts! While many of those special effects seen in movies are way too complex for us to redo here in our library-lab, Milli and Avogadro gave us a few that are actually easy to do. We are going to recreate a few of these special effects ourselves, and learn how chemistry, not magic, explains how they work!!

Experiment 1: Fake Snow (Group Experiment)

Experiment Purpose & General Methodology

- Students will make fake snow.
- Students will learn about polymers, osmosis and superabsorbancy.
- Students may notice the warmth given off by the original slightly exothermic reaction and will afterward notice a cooling of the material due to surface evaporation of the water.
- The experiment will require about 3 minutes and is to be performed at each table.

Introduce the Experiment

1. Did you know that parts of the movie *A Christmas Story* were filmed right here in Cleveland? Believe it or not, there was no snow in Cleveland and they had to use soap suds.
2. Milli and Avogadro were very surprised when they first walked into their movie set. Even though they were in a sunny and warm location, there was snow everywhere! How could this be?! Is it magic? We think not. We have a more realistic snow that's even a bit cold when produced.
3. The future of snow! You can create snow any time in almost any climate just like they do on movie sets. Fake snow is also used in indoor snow parks because it will not melt or ice up.

Performance Details:

Do the following, leading the students:

1. Have a student at each table pour the 3 oz. cup of water marked "W" into the cup in the center of the table and watch: the snow should grow (without any stirring) and overflow - spilling over the edge of the cup.
2. Have the students touch the cup, does it feel cold? *No/maybe.*
3. Be sure to NOT eat our snow! It is not frozen water.
4. Have the students touch the fake snow; does it feel warm or cold? Both answers may be correct. Wait a minute while you continue talking and have them touch it again in a few minutes. Is it cold later? *Yes.*

Conclusions

Tell the students the following:

1. Our fake snow is a polymer. The word polymer simply means long chain of molecules (“poly” means many and “mer” is a unit or molecule).
2. The process by which Insta-snow works is by soaking up the water by osmosis (water molecules pass through a barrier from one side to the other). When water comes into contact with the polymer the water moves from outside the polymer to inside and causes it to swell. When it's dry, the polymer's structure is compact and does not take up much room. When you add water, the water fills in many spaces between the polymer spaces and thus it swells up. This reaction is slightly exothermic which is why soon after you add the water it might have felt just a bit warm.
3. The polymer is only able to hold so much water and stretch only so far. Otherwise it would grow to be as big as a house.
4. The Insta-snow polymer is known as a “superabsorbent” polymer absorbing over 100 times its weight and 40 times its volume in water.
5. Even though we've added water and the reaction originally gave off heat, there is another process going on here too. The very fine particles of polymer create a large surface area allowing the water to evaporate. As the water evaporates it uses heat from its surrounding causing a cooling effect. This is known as evaporative cooling. You experience this whenever you feel cold after getting out of a swimming pool all wet.

Additional Information If Needed: Technical Background

- SAFETY: If fake snow is ingested or gets into the eyes, flush with generous amounts of water.
- Insta-snow is sodium polyacrylate.
- When water is added to this granular white powder, it instantly expands to 40 times its original volume, producing a snow-like material. Great for showing that there is No Law of Conservation of Volume! This artificial "snow" is fluffy and can be readily poured. When wet, it adheres well to boots and is very slippery. It was used in Steven Spielberg's mini-series, *Band of Brothers*, and is becoming popular as an artificial base for skiers. You can carry almost two cubic meters of snow in your briefcase; just add water! Its MSDS is the same as for sodium polyacrylate, the 'diaper' polymer!

Any additional information for the teachers who receive this kit

- Be aware of the timing of temperature effects: Immediately after hydrating the snow polymer, have the students touch the expanded material. It should be slightly warm to the touch as the reaction between the water and the polymer is slightly exothermic. If students touch a sample of snow that was previously expanded (10 minutes or more) they will find it cool to the touch.
- <http://instantsnow.org/>

Experiment 2: Levitation (Group Experiment)

Experiment Purpose & General Methodology

- Students will see a monster levitate above the snow.
- This experiment shows the repelling force of two magnets due to magnetic fields.
- The experiment will require about 7 minutes and is to be performed at each table.

Introduce the Experiment

Tell the students the following:

1. The next thing that Milli and Avogadro saw made them not believe their eyes. There was a monster walking on the snow, but ... wait... he was walking ABOVE the snow, leaving no footprints. How is this possible? Let me show you.

Performance Details:

Do the following, leading the students:

1. Play with the magnets to see that they can attract or repel. Magnets will either attract or repel depending on if their magnetic fields are lined up or not.
2. Tell the students to take one of the two ring magnets and place a glue dot on one flat top edge – just a bit toward the edge so that the glue dot does not overlap the hole in the ring.
3. Now stick the back of the monster's feet onto the glue dot; again, do not overlap the hole.
4. This represents our monster, as we would see him in the movies. If we were making a movie, we'd have to hide our magnet by hiding them in his shoes or "erasing" them from the film using computer graphic effects.
5. Now line up the magnets so that they repel each other; holding them vertically so that the monster-magnet combo is above the second free magnet.
6. Have someone take the straw, bend it at its perforation, and hold the long side vertically (up and down) and the short side horizontally (level with the table) so that their scientist friends can slide the magnets onto the long side without them falling off.
7. Slide the 'free' magnet (without the monster) down onto the straw.
8. Now slide the magnet with the monster onto the straw above the other magnet.
9. See how it the magnets repel. This could be used to lift our monster off the ground! In the movie we wouldn't need anything like our straw; this is just to make it easy to not drop them. This first magnet might have been in the monster's shoes; the second 'free' magnet might be hidden under the snow.

Conclusions

Tell the students the following:

1. One of the most amazing things about magnets is the way they can attract other magnets 'at a distance', or 'invisibly', through what we call a magnetic field.
2. Everything is made of billions of atoms, which contain tiny particles called electrons. Electrons make up the flow of electricity.
3. A "force" is a description of the interaction between two items. I can push on the table to force it to move.
4. Magnetism is a force field created by electric currents caused by moving electrons – the force of magnetism can pull or push other magnetic items.
5. My force in pushing a table requires me to touch the table. The magnetic force can penetrate through air, without us seeing it! Pretty neat!

Additional Information if Needed: Technical Information

- Magnets strongly attract steel, iron, nickel, cobalt, and gadolinium.
- Students will know about the North and South Poles on Earth. Magnetic materials are attracted to the **poles** of the magnet. On a bar magnet the poles are at either end of the magnet. Poles occur in pairs of equal strength. One pole - North seeking pole - points roughly to the Earth's North Pole. Other pole – South seeking pole - points roughly to the Earth's South Pole. The common rule is: **Like poles repel while Unlike (or opposites) poles attract.**
- The force between magnetic poles decreases as their separation increases.

Any additional information for the teachers who receive this kit

- <http://www.le.ac.uk/se/centres/sci/selfstudy/mam.htm>
- <http://science.howstuffworks.com/magnet.htm/printable>. This is more advanced.

Experiment 3: Monster’s Foaming Mouth (Individual Experiment)

Experiment Purpose & General Methodology

- One of the main features of any self-respecting monster is that it be able to foam at the mouth.
- On our “movie set” we will simulate a monster’s foaming mouth using chemicals.
- Students will learn that one way to notice a chemical reaction is the formation of a gas. (This is gas formation caused by a chemical reaction which is very different from vaporization of a liquid caused by heating.)
- This experiment will take about 3 minutes to complete and will be done in two parts.

Introduce the Experiment

Ask/tell the students the following

1. Did you see the movie Harry Potter? Do you think that the actor who plays Harry has a real scar in the shape of a lightning bolt on his forehead? Did you see Nanny McPhee? Do you think that Nanny McPhee really has a face with a big wart, large ears, and a snaggle tooth?
2. These actors have been given some make-up to make their faces look different. There is a person called a Special Effects Make-Up Artist who helps make real actors look different. They have to use chemicals to make pastes and clays and plastics to change a face or make a mask or a body part.
3. Milli and Avogadro saw a monster walking above the snow. What did the monster’s face look like... why they didn’t tell us! We are going to pretend that we are a Special Effects Make-Up Artist at work and “Make a Monster Face” – scary or funny! We’ll use CHEMISTRY to show you that a plain face can be made to look just about like anything you want it to.

Do the following:

1. Have each student take a small paper plate and a pencil.
2. Show them your example, and then ask them to draw in the center of the small paper plate (not close to the edges) two eyes, a nose, and a mouth for their monster with large lips and possibly some teeth. We’ll add hair and other items later. This should be a very simple face with little detail.
3. We’ll now begin making our own monstrous faces. To keep our areas a bit cleaner, we’ll place our monster face plate on top of / inside of a larger paper plate.

Experiment 3 – Monster’s Foaming Mouth

Presenter’s Guide

Part A: Setup (we will complete this section, allow the glue to dry and then return for the completion after Experiment 7 is completed.)

Ask/Tell the students:

1. If you ever saw a monster wandering through the snow, like Milli and Avogadro did, and you looked carefully at his mouth, what would be special about it? *Answer: monsters are fierce creatures that often have bad teeth and they foam at the mouth.*
2. In the movies many features like the foaming mouth can be simulated by special effects.
3. We’ll try to do the same thing with chemistry

Do the following:

1. Place the large plate under the small plate; it will help contain any fun messes we make!
2. At each table, pass the 3 oz cup marked “G” containing Elmer’s glue from student to student.
3. Holding this cup over the mouth on their paper plate, each student in turn should carefully dip one end of their Q tip into the glue one time. Taking care not to drip the glue, spread the glue over the lips/teeth of the mouth.
4. Each student should then carefully and slowly sprinkle the contents of their cups marked “B” (baking soda) **evenly** onto the glue. When the glue has been covered with baking soda, tell each student to dump the excess baking soda onto their paper towels and then carefully put this towel into the brown paper bag.
5. When all students have completed this portion ask them to place the Q-tip into the brown paper bag.
6. Say: Did you know that baking soda was once used as toothpaste! Don’t worry; we will not make our monster’s smile too pretty (*chuckle*). I promise you it will be scary later, but first we need to let the glue dry, so we’ll return to this experiment later.

Experiment 4: Monster’s Hair (Individual Experiment)

Experiment Purpose & General Methodology

- Each student will create colorful hair for their monster.
- Students will learn that phenolphthalein is an acid-base indicator turning a bright pink or fuchsia color in presence of a base.
- The alcohol will evaporate leaving behind no sign of the future “hair”
- Later in the program a basic solution (household ammonia) will be painted over the area of the “hair” in order to change the color of the indicator to the fuchsia color.
- The experiment will require about 3 minutes and is to be performed each student at each table.

Introduce the Experiment

Tell the students the following:

1. Pass out the solution cups “P” at this time while you issue this safety message:
Remind the students that they must have their goggles on at all times. Tell them that the solution you are passing out has fumes which they should avoid smelling as much as possible and that the solution should not be touched with their hands as it can be irritating and harmful to their health. Tell them that you will be using Q-tips to avoid those possible problems. Please tell them to notify you if the solution spills at their table. See box on page 4 for exposure information.
2. Tell them here are many chemicals that have the ability to change color when reacted with other substances. Some may be invisible or clear and then become visible, changing to a color, when they react with another chemical.
3. Ask the students if they know of such chemicals that have been used in films and books? (*invisible ink*)
4. Tell them we are going to use a special chemical called an acid-base indicator that changes color when exposed to an acid (*like lemon juice or vinegar*) or a base (*like washing soda, baking soda or lye*)
5. This particular indicator is called “phenolphthalein” (quite a mouthful to say). It is not soluble in water but is soluble in alcohol so you will smell the alcohol when you use it. It has no color in alcohol but does when we later create the color change for our monster’s face.

Performance Details:

Do the following, leading the students:

1. Today we are going to paint some hair onto our monster’s face. Each person at the table should locate the portion cup marked “P”.
2. Tell each student to obtain one dry Q-tip.
3. Ask if the students know how to tell time on a clock with numbers? If there is at least one student at each table ask them to help the others know where to paint the hair.
4. Let them know that they will be painting hair on their monster in the area above the eyes from about 10 o’clock to about 2 o’clock.
5. Demonstrate this by placing the Q-tip in the solution marked “P” and then marking the indentations on the 10-2 o’clock area.
6. Show that you will probably have to do this several times to complete the hair painting.
7. Tell the students to put the Q-tip into the brown paper bag attached at the front of their tables when they are finished and ask the assistant (if there is one) to collect the cups marked “P”. Cover the cups at the demonstrator’s table with the index card previously used.

To be continued:

Tell the students the following:

1. Tell the students to pay close attention to their hair. It will “disappear” but really the alcohol is evaporating leaving behind the colorless chemical.
2. Let them know that they will come back to the hair later in today’s program.

Experiment 5: Monster’s Skin (Individual Experiment)

Experiment Purpose & General Methodology

- The students will learn the technique of filling a syringe to a specified volume.
- Measuring each item will help the student in their math and motor skills.
- The students will prepare a polymer that will resemble scar tissue or artificial skin.

Introduce the Experiment

Tell the students the following while you distribute one cup marked “J” containing the gelatin and one cup marked “DG” containing the diluted glue to each table.

1. Science and art come together in this experiment. Adding a little bit more water, adding a little bit more gelatin, or a little bit more Elmer’s glue creates the “art” form for the perfect special effect.
2. We will learn some new measuring techniques in this experiment.
3. This experiment can be done with items that are often found in the kitchen and this can be repeated with your parent’s help. Maybe at Halloween?
4. The skin we see on actors has to be flexible and look real. This is done by making a rubbery polymer, which is safe to the skin.
5. Ask the students if they know what Jell-O is made from. (*Answer: Gelatin, sugar and flavorings*).
6. We will be creating a polymer that can be placed on our drawing project. Normally, this is called “makeup”. Scary.
7. Tell them that Elmer’s Glue is a building block for making polymers that are flexible.

Performance Details:

Demonstrate the following, having the students follow your guidance:

1. Ask the students to locate one plastic cup marked “R” and place it in front of them.
2. Ask the students to locate a plastic syringe on the table. Tell the students that each of them will do this so please take turns.
3. Ask the students if they know where syringes are used? (*Answer: hospitals and laboratories*)
4. Tell the students that you will be showing them the proper way to use a plastic syringe but first you need to name the parts of the syringe. Note that our syringes have no needles because we don’t intend to give our monster a shot today!

Experiment 5 – Monster’s Skin

Presenter’s Guide

5. You have the tip of course. Then you have the tube which has markings 1 through 10 on it. These are markings called “graduations” for the volume inside the tube and the method we will use to measure our required volume today.
6. Last is the plunger which is used to fill the tube. Demonstrate to the students as you tell them “to pull the plunger out to fill and push it in to release the contents into a container.” Notice that there is a black ring around the plunger. You will want to pull the plunger back until the black portion is on the “7” mark after you have removed the air in the syringe.
7. Ask the students to locate the plastic cup marked “DG” for “diluted glue.”
8. Ask the students to please watch you carefully. Explain what you are doing as you go in detail.
9. Tell the students that it is important to put the tip of the syringe INTO the liquid before they pull up on the plunger. Otherwise they will get air into the syringe and the experiment will not work well.
10. Now pull back the plunger about half way and then push it in again. Do this several times so that all the air is out of the syringe and you will have the correct amount in the next step.
11. Now slowly pull out the plunger until the black rubber bottom of the plunger hits the “7” cc mark.
12. Carefully empty the contents of the syringe into the empty 4 oz plastic cup marked “R”.
13. Now pass the syringe to the next person. Ask one student at each table to hold the glue cup at an angle (demonstrate this) so that it is easier to get the tip under the glue. This is very important for the last two students who need to obtain the glue.
14. When all students have their 7 ml of glue solution, ask the students to locate the cup containing the gelatin marked “J.”
15. Ask the students to watch the measurement technique you need them to follow today.
16. Fill up the plastic spoon with gelatin from the cup. Holding the spoon over the cup, pick up the stirring stick and use it to “level off” the spoon with the excess going back into the cup containing the gelatin.
17. Tell them that this is an important measuring step. Ask students to assist the others at the table by tilting the cup so they may get the spoon full.
18. Tell them that once they have their gelatin they need to add it to the glue and stir until they count to 50 or until it is fairly thick.
19. Allow the mixture to thicken for a minute.

Experiment 5 – Monster’s Skin

Presenter’s Guide

20. Tell them that most cooks prepare their recipes by measuring dry ingredients like flour, sugar and spices by “leveling off” their spoons and cups just like they did today. .
21. Demonstrate how to apply the skin mixture with the wooden stick to the face already prepared on the plate. Lay the skin or scar on thickly and allow it to “dry”.

Conclusions

Tell the students the following:

1. Tell the students that while there is no obvious chemical reaction in this portion of the activity, the dilute Elmer’s Glue (vinyl alcohol mixture) thickens the mixture by reacting with the gelatin to form weak polymers that are shaped into skin or scar tissue.
2. Let them know that they will use their scar tissue in the next experiment.

Additional Information If Needed: Technical Background

- Each person will get a chance to operate their own syringe. It will take two hands and some practice to load the syringe. Be patient. The presenter must demonstrate how to operate the syringe. Practice at home before the program with plain water. One way to get rid of any air space is by pointing the syringe into the air and work the plunger. Just like the nurse or doctor. This will be too messy at the program site so be sure to prove to yourself that by moving the plunger in and out several times you also can eliminate the air. Any excess glue expelled while adjusting the volume to 7 ml should be captured with a paper towel as it comes out of the syringe barrel. The exact volume is somewhat critical (7 ml +/- 0.5 ml).
- The “skin” or scar tissue formed is pliable for about an hour, especially when it is placed on real skin. Making scars and scabs is a neat Halloween costume trick too.

Any additional information for the teachers who receive this kit

- http://www.essortment.com/lifestyle/howtomakefake_svld.htm
- http://www.zombiemaker.com/makeup/gelatine_skin_basics
- http://www.ehow.com/way_5816028_homemade-fake-wounds.html

Experiment 6: Monster’s Blood (Individual Experiment)

Experiment Purpose & General Methodology

- Each student will react two chemicals which are placed upon their face’s “scar” to create blood.
- Students will learn that one way to determine if a chemical reaction occurs is to observe a color change.

Introduce the Experiment

Ask the students the following while you distribute the cup marked “1” and 10 beral pipets to each student table.

1. Ask the students what their favorite movie special effect is (other than explosions).
2. Say that some movies have a G (general entrance) rating and others may have a PG rating for parental guidance because they are scary. Ask the students what they’ve seen in moving which they find scary. (*Answers will vary but **direct them to blood***).
3. Tell them they can be relieved by knowing that the ‘blood’ used in films is fake. They are going to create their own special effect by making fake blood using a special chemical reaction.
4. Explain that chemical reactions occur when two chemicals produce something completely new when mixed. This is different than mixing salt and sand which can easily be separated later and still are the same materials with no changes.

Performance Details:

Do the following, leading the students:

1. Tell the students that now we are going to create a bloody scar.
2. Have the students each get one beral pipet.
3. Have the students locate the portion cup marked “1”.
4. SAFETY note: Remind the students not to touch or taste the chemicals. Students need to have their goggles on.
5. Demonstrate that the students should gently squeeze on the pipet, put the tip under the solution and suck up just enough liquid to reach the top of the stem or the top of the straight part of the pipet. If they have too much, have them squeeze some back into the cup so that everyone will have enough solution.
6. Tell them not to do anything more at this point.
7. Now demonstrate to the students that you will place 10 drops of the solution from

- portion cup “1” on top of the scar on their face.
8. While they are doing the previous step, distribute the portion cups marked “2” among the tables now. Warn the students not to touch this solution yet.
 9. As soon as the students add the drops of liquid “1”, have them dispose of the pipet in the brown lunch bag attached to the front of their tables. Collect portion cup “1” so that there is no cross contamination in the next step.
 10. Ask the students to locate portion cup “2”.
 11. Ask the students to take a **clean** pipet and again suck up just to the curved part of the pipet with this “2” solution.
 12. When all students have done this have everyone simultaneously place 10 drops over the scar.
 13. Instantly you will see the red color of the complexed iron—you should hear lots of excitement!
 14. Dispose of this pipet in the brown paper bag. This will prevent contamination later.

Conclusions

Tell the students the following:

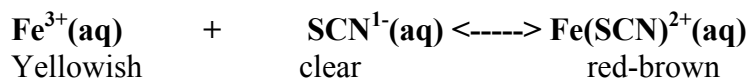
Ask them if they have learned some different ways that indicate a chemical reaction has occurred today so far. (*color changes, products that are different than the components*).

Procedural Note:

Take away portion cup “2” at this time to avoid contamination later.

Additional Information If Needed: Technical Background

- The thiocyanate iron(III) complex ion, $\text{Fe}(\text{SCN})^{2+}$, which forms when you mix solutions containing ferric ion, Fe^{3+} and thiocyanate ion, SCN^- , as indicated by the following equation:



Since the $\text{Fe}(\text{SCN})^{2+}$ formed is an intense red-brown colored complex ion with an absorption maximum at about 447 nm, its presence can easily be determined by the intense color change that occurs when it forms.

- Fake blood sites:
www.wikihow.com/Make-Fake-Blood
<http://chemistry.about.com/cs/howtos/ht/fakeblood.htm>
<http://www.fabulousfoods.com/recipes/article/555/18424>
http://www.halloween-website.com/fake_blood.htm

Experiment 6 – Monster’s Blood

Presenter’s Guide

Any additional information for the teachers who receive this kit

- For more information on complex ions:
<http://www.chemguide.co.uk/inorganic/complexions/ligandexch.html>

<http://higheredbcs.wiley.com/legacy/college/spencer/047165552X/modules/mod3.pdf>

Completion of Experiment 4: Monster's Hair

At this point we revisit this experiment to develop the hair.

Performance Details:

Do the following, leading the students:

1. Tell the students that now we are going to paint another chemical onto the hair that we prepared earlier in the program.
2. Distribute the portion cups marked "A" among the tables at this point. Warn the students that they will smell the odor of ammonia and not to get any of the solution on themselves or in their eyes. SAFETY: be sure to double check that each student has their goggles on.
3. Ask each person at the table to locate the portion cup marked "A".
4. Tell each student to obtain one dry Q-tip.
5. Let them know that they will be painting another solution over the hair they previously painted onto their monster in the area above the eyes from about 10 o'clock to about 2 o'clock.
6. Demonstrate the range of the area to be re-colored by placing the Q-tip in the solution marked "A" and then marking the indentations on the 10-2 o'clock area.
7. Now "paint" between the two marks to make a solid-colored hair section. Show that you will probably have to do this several times to complete the hair painting.
8. Tell the students to put the Q-tip into the brown lunch bag attached to the front of their tables. When they are finished collect the index cards and the cups marked "A." Cover the cups with the index card until the end of the program.

Conclusions

Tell the students the following:

1. Ask the students to describe the color of the hair now. (*Pink, fuchsia*)
2. Tell them they have just reacted the phenolphthalein solution with a base and changed its color characteristics
3. Tell them they will now do another experiment and the color of the hair may fade again to colorless as the ammonia evaporates.

Additional Information If Needed: Technical Background

- <http://www.elmhurst.edu/~chm/vchembook/186indicator.html>
- <http://www.scifun.org/> experiments to do at home and much other information

Any additional information for the teachers who receive this kit

- See Appendix

Experiment 7: Monster’s Blue Face (Individual Experiment)

Experiment Purpose & General Methodology

- Each student will create a deep blue color for the face by reacting two chemicals placed on the open areas of the face remaining.
- Students will observe the chemical reaction creating a deep blue solution from two nearly clear ones.

Introduce the Experiment

Tell the students the following:

1. *While you are introducing this experiment distribute one portion cup marked “3” and ten Q-tips to each student table.*
2. *Remind the students that they have now created a face, a mouth, hair and scar tissue for their monster but it needs to be a bit more dramatic.*
3. *Ask them what the name of the big 3D movie was last year. (Avatar)*
4. *Ask what the color of these creatures were. (blue)*
5. *Tell the students that you will now create a colored face for their own monster.*

Performance Details:

Do the following, leading the students:

1. *Ask the students to each get one dry Q-tip.*
2. *Ask the students to locate the portion cup marked “3”.*
3. *Tell the students they will do the same procedure that they did with painting the hair on their monster—only this time they will paint the portions of the face but NOT the mouth or scar or hair.*
4. *Demonstrate that the students should dip their Q-tip into the solution and cover the dry areas on the paper plate face. They will have to do this several times to cover the face and they need to do this and the next painting step QUICKLY. (The solution needs to be wet in the next step for best results). Distribute portion cup “4” while they do this part.*
5. *When all students have completed this portion ask them to place the Q-tip in the brown paper bag.*
6. *Presenter: Please remove the portion cup “3” from the tables to avoid contamination.*
7. *Have them select another dry Q-tip and paint over the areas they just painted with solution “4”. There should be an immediate blue color!*
8. *Have the students put the used Q-tip into the brown paper bag.*

Conclusions

Tell the students the following:

1. Ask the students if this was another example of a chemical reaction. (*Yes!*)
2. Once again we combined two nearly clear solutions and produced a bold color. This reaction actually created a paint pigment known as “Prussian Blue.”

Additional Information If Needed: Technical Background

- Prussian blue paint (discovered in the early 18th century) is created by mixing hydrates of iron (III) chloride (a yellowish solution) with potassium ferrocyanide (a nearly colorless solution) to form a highly colored very stable complex blue ion:
- $\text{FeCl}_3 + \text{K}_4\text{Fe}(\text{CN})_6 \rightarrow \text{KFe}(\text{II})\text{Fe}(\text{III})(\text{CN})_6 + 3 \text{KCl}$
- This results in a mixed valence compound which undergoes charge transfer. The energy associated with the readily shifting electron between the two iron ions is about the same as the energy of light in the red, orange, and yellow parts of the spectrum (500-700 nm wavelengths). As a result, Prussian blue absorbs these colors and reflects the bluish part of the spectrum.
- Prussian blue is often sold as Laundry bluing.
- The FDA has determined several uses for Prussian blue:

<http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness/ucm130337.htm>

Any additional information for the teachers who receive this kit

- <http://www.webexhibits.org/pigments/indiv/recipe/prussblue.html>

Completion of Experiment 3: Monster's Foaming Mouth

Part A: Setup

Tell the students:

1. Earlier in our program we started to make a scary mouth for our monster. So far we have only glued down some baking soda.

Part B: Completion

1. Tell the first student at each table to pass the cups marked "V" to each student. Using only one squeeze, each student should fill his/her beral pipet with vinegar (about a quarter of the way up the bulb portion) and then gently and **slowly** squeeze the vinegar evenly onto the dried glue-baking soda mixture.
2. This mixture should foam vigorously to complete the monster's special effects. You should hear lots of "oohs" and "aahhs".
3. When all students have completed this portion ask them to place the pipet in the brown paper bag.

Conclusions

Tell the students the following:

1. When you learn more about chemistry, you'll learn about acids and bases. Long ago, people dangerously tasted things to see if they were acids (sour) or bases (bitter), but it's not reliable or safe. Chemists now have better ways. Here our acid, vinegar, reacted with a base, baking soda, in a chemical reaction that formed new chemicals, including a gas, carbon dioxide. One way to recognize a chemical reaction is to see the formation of a gas. This gas bubbles up through the liquid vinegar, creating the foaming action. Don't worry though; carbon dioxide is the same gas that we breathe out everyday, so it won't hurt you.
2. If the movie were about monsters, one of these special effects would be the creation of the monster's foaming mouth.
3. In this experiment we've seen how simple household chemicals can be used to create realistic special effects.
4. In fact, without chemistry many special effects wouldn't be possible.

Additional Information If Needed: Technical Background

- The chemistry behind this experiment is familiar to most: when combined with acids such as acetic acid, sodium bicarbonate decomposes into CO₂ and water:



Closing Session

Close the Program:

- Finish the Story: Say: "I hope you enjoyed our adventures behind the scenes that we took with our friends Milli and Avogadro. Making snow, using magnetism to make a monster float, and creating a monster's scary face are just some of the cool special movie affects you can explain with Chemistry and Science."
- Remind the students to check our website for information on how to participate in our Chemistry and Poster Contests where each student receives a small token for entering and can win local and national cash prizes. They should also be able to find us by searching under "Cleveland" and "National Chemistry Week".
- Thank the students and parents for coming to this year's demonstration and learning about science and chemistry.
- Remind the students to share our experiments with their family and friends. To the students say **"I'm sorry but due to some of the chemicals we used, and the great fun mess we've made (say this to keep it light-hearted) we cannot take our monster faces home with us. Instead, we have a handout so that you can make your own monster face at home. We also have a special monster for you to take home. We also have a list of books you can get from the library with more fun information on movie special effects."**
- Tell the students that, as much as we'd like to, we can't allow them to take the magnets home.
- Have students come up to the closing area to turn in their goggles, and pick up their take-home sheet, *Celebrating Chemistry* newspaper and monster gift.

1. **CLEAN UP FOR LIQUIDS:**

- Add a few cups of water to the bucket to prepare for dilution of our chemicals.
- Pour the solutions from Experiments Blood and Blue Face (Vials 1-4 and Cups 1-4) onto the newspaper and throw away with the solid trash. The iron will complex with the ions forming the Prussian Blue pigment which may be disposed on in the solid trash.
- Then pour all other excess liquids into your bucket. Then pour into a toilet and flush.

2. **GENERAL CLEAN UP PROCEDURES FOR EXPERIMENTS**

- All solid waste can be placed into a regular trash bag.
- Check with the librarian if they are willing to take the trash; otherwise, please dispose of it with your own trash.

3. **PLEASE FILL IN THE FEEDBACK FORM**

- We need this information to write the reports required by ACS National and industrial donators of supplies.

4. **USE ENVELOPES PROVIDED** labeled "Julia Boxler YTH" (via inter-library mail):

- Into one of the envelopes place:
 - Signed photo permission forms w/ a description of the photo to which it belongs
 - Completed Feedback form
 - Magnets (with or without monsters)
 - Unused teaspoons, pipets, vials/lids, etc (non-crushable items).
 - NO VIALS OF SOLUTIONS PLEASE
- Into one of the gallon sized baggies (squeezing out the excess air) and then into the second envelope place:
 - USED Vials (not the glue bottle) (rinsed well and placed into one of the zipped experiment bags). Remove air from the bag before sealing it to reduce volume and be sure it is sealed.
 - Syringes - Rinse the syringes by pulling the plunger in and out several times while under water. Then gently remove the plunger entirely and rinse both the tube and plunger thoroughly. Please wipe dry and place in a separate gallon sized baggie, squeeze out the excess air and seal the bag. Place in the second envelope.

5. **GOGGLES:**

- If you are performing another demonstration for this year's National Chemistry Week, sanitize the goggles between demonstrations with a dilute bleach solution as instructed in the written directions found on the inside cover of the goggle container. Be sure to


dry them with soft cloth or soft paper towels to prevent scratching. Please stack them into their box without twisting or crushing!

- If you are finished performing your demonstration(s) for this year, place the used goggles into their box. Please stack them without twisting or crushing! (There is no need to clean them when you are through; our committee will clean them for the next year and/or for other programs.)

6. LASTLY AT THE LIBRARY

- Return items borrowed from the library.
- Give any leftover literature to the librarian. (You may save a copy for yourself though!)
- Give the mailing envelope (containing saved supplies and feedback form) as well as the box of goggles to the Children's librarian with instructions to put it them in the interlibrary mail to *Julia Boxler - YTH*. (Or take to your nearest CCPL library, as instructed at the start of this script).

7. AT HOME:

- If you didn't return a completed hardcopy of the feedback form after your demonstration, please go to our web site and complete the electronic feedback form. When complete, please email this to Bob Fowler at fowler@en.com.
- If you took any photos to share, and have submitted signed permission forms to use them, email the photos to Bob Fowler fowler@en.com or Kat Wollyung at ACS.NCW.Kat@gmail.com. Please be kind to our in-boxes and do not send multiple large files all in one email.
- **Smile!** You may have expanded or even sparked scientific interest in a student today!


THANK YOU! ...for your participation in our program this year.

We hope you will join us next year too. Planning of experiments and contests starts in late April. You don't have to be a teacher or scientist to join our Planning Committee; all you need is a desire to share science with students. Development of ideas and refinement of experiments goes on throughout the summer (a couple of hours every other week), donation gathering and shopping is in late summer, and kit assembly (over 100 of them!) (needing a lot of volunteer hands) is on a Saturday in late September. It takes many, many volunteers to develop and put on all our programs. Even a little bit of help goes a long way. Contact us this year or next year if you (or a friend of yours) want to join in on the preparations!

Thanks again!!!

Kat Wollyung (ACS.NCW.Kat@gmail.com)
Bob Fowler (fowler@en.com)

Appendix**A. Material Safety Data Sheets**

MSDS sheets for all materials used in this year's program may be found on our web site at http://www.csuohio.edu/sciences/dept/cleveland_acs/NCW/.

Instant snow

<http://www.flinnsci.com/Documents/MSDS/IJ/InSnPow.pdf>

Vinegar

<http://www.flinnsci.com/Documents/MSDS/UV/Vinegar.pdf>

Sodium bicarbonate

<http://www.flinnsci.com/Documents/MSDS/S/SodBicar.pdf>

Phenolphthalein

<http://www.flinnsci.com/Documents/MSDS/OP/PhenolphthaleinSol.pdf>

Household ammonia

<http://www.flinnsci.com/Documents/MSDS/A/Ammonia.pdf>

Gelatin

<http://www.flinnsci.com/Documents/MSDS/G/Gelatin.pdf>

Glue

<http://www.flinnsci.com/Documents/MSDS/G/GlueWhit.pdf>

FeCl₃

<http://www.flinnsci.com/Documents/MSDS/IJ/IrChloSoA.pdf>

KSCN

<http://www.flinnsci.com/Documents/MSDS/OP/PotThiSo.pdf>

K₄Fe(CN)₆

<http://www.flinnsci.com/Documents/MSDS/OP/PoFerroS.pdf>

B. Supply list for recreating these experiments including item substitutions

Experiment 1 – Instant snow www.stevespanglerscience.com or science toy stores

Experiment 2 – Magnets – allmagnetics.com PomPoms – OrientalTrading.com

Experiment 3 – All of the materials required for this experiment are household items that can be purchased at any grocery or school supply store

Experiment 4 – Phenolphthalein - Flinn Scientific item # P0018 www.flinnsci.com

Freshly prepared Red Cabbage juice may be substituted—the initial color will be reddish on the plate and change to greenish when the ammonia is used.

Experiment 5 – none.

Experiment 6 – 0.1M $K_4Fe(CN)_6$ potassium ferrocyanide Flinn item # P0250

Substitution: add to corn syrup, glycerin or liquid starch a mixture of food coloring that is a ratio of 5 drops of red color to 1 or 2 drops of blue coloring.

Experiment 7 – 0.1 M $FeCl_3 \cdot 6H_2O$ iron (III) chloride Flinn item # F0070
 0.1M KSCN potassium thiocyanate Flinn item #: P0178

Substitution: add blue food coloring to corn syrup, glycerin or liquid starch.