

# Directions for Chemsations Demonstration Show

## Disappearing Ink

**Spilled blue ink turns colorless when you blow on it.**

### Materials needed

1. a basic solution of thymolphthalein in ethyl alcohol in a squirt bottle
2. a white cotton cloth or a demonstrator wearing a white shirt

### Demo

1. “Accidentally-on-purpose” spill ink on a white cloth or shirt.
2. Then blow on the cloth or wave it in the air. The blue color will fade away.

### Hints and Notes

1. If blue doesn't last long enough, add a drop of about 3 molar sodium hydroxide to the ink solution.
2. If the ink color lasts too long add a drop or two of vinegar to the ink solution.

### What is happening?

Thymolphthalein is an acid-base indicator that is blue in slightly basic solutions and colorless in slightly acid solutions. When you breathe on the cloth the carbon dioxide in your breath reacts with the base and lowers the pH of the solution so that the indicator turns colorless.



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# Rainbow Tube

**A hollow rod is filled with liquid and then can be made to show rainbow colors.**

## Materials needed

1. about 500 milliliters of water with enough Bogen's universal indicator added to make the solution green
2. a 3-foot long, 1-inch diameter tube with a rubber stopper in each end
3. A small dropping bottle with dilute sodium hydroxide solution and a small dropping bottle with dilute hydrochloric acid solution. The acid and base should about the same molarity.

## Demo

1. Stopper one end of the tube and fill the tube with the universal indicator solution. Leave about 3 inches of space at the top.
2. Add a few drops of dilute acid to the indicator solution. Tightly stopper the tube and turn it over. Now add a few drops of base to the tube and tightly stopper.
3. Turn the tube over to get a rainbow effect.
4. For increased visibility hold the tube in front of a strong light.

## Hints and Notes

1. Make sure that the stoppers are in tightly and there is an air space of a few inches in tube.
2. If there is no air space, when you put in one stopper the other one will pop out and you will have wet green shoes.

## What is happening?

Universal indicator is a mixture of several indicators that change color at different pHs. As the pH of a solution changes from low pH to high pH, the indicator changes from red to orange to yellow to green to blue. As the acid at one end of the tube and the base at the other end of the tube diffuse toward each other they create a pH gradient from low pH to high pH and the rainbow colors result.



# Disappearing “Witch”

**Styrofoam rectangle slab “magically” disappears when put in a bowl.**

## Materials needed

1. a shallow clear glass bowl
2. flat piece of Styrofoam™
3. 20 milliliters of acetone

## Demo

1. Before the show, out of sight of the audience, pour the acetone in the bowl, and draw the outline of a witch on Styrofoam™.
2. Place the Styrofoam™ in the bowl while holding the bowl so the audience can see in it.
3. Cup will appear to slowly disappear into the bowl.

## Hints and Notes

1. Acetone is very flammable!

## What is happening?

The acetone causes the polymer strands in the cup to slide apart, letting the gas out of the foam. The Styrofoam™ collapses. The Styrofoam™ does not melt.



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# Disappearing Water

**Water is poured into a cup; the cup is then turned upside down and the water seems to be gone.**

## Materials need

1. an opaque cup or glass
2. 100 milliliters of water in any kind of container
3. 10 grams of sodium polyacrylate polymer powder (called “Aqua lock,” or “water lock,” or “super slurpy polymer“)

## Demo

1. Before the show, out of sight of the audience, put the water lock powder in the opaque cup.
2. Pour the water in to the opaque cup. Wait a few seconds then turn the cup over to show that the water appears to be gone.

## Hints and Notes

1. A Styrofoam™ cup works as well as the opaque cup.
2. Be sure to wait a few seconds before turning over the opaque cup so that water lock has time to absorb all of the water.

## What is happening?

The opaque cup contains water lock powder that quickly absorbs the water and forms a gel that doesn't come out of the opaque cup when it is turned upside down. Water lock is the material that is in disposable diapers to keep the baby dry.



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# Red Green Reaction

**A yellow solution first turns red when stirred, then turns green when shaken vigorously. On standing the solution turns back to green.**

## Materials needed

1. a 1 liter screw cap glass bottle
2. 250 milliliters of water
3. 3 grams of dextrose
4. 5 grams of sodium hydroxide
5. between 5 and 10 milliliters of 1% indigo carmine solution

## Demo

1. Dissolve the sodium hydroxide in the water, next add the dextrose and stir until it has also dissolved.
2. Pour the water solution in the screw cap bottle, add the indigo carmine solution and immediately cap the bottle. The solution should now be yellow.
3. Gently swirling the liquid in the bottle will cause the solution to turn red orange. Vigorous shaking will cause the solution to turn green. On standing, the solution will again turn yellow. The process can be repeated several times. The reaction will no longer take place after about an hour.

## What is happening?

The oxygen in the air in the bottle is reacting with the indigo carmine to change its color from yellow to red. More oxygen causes the red to change to green. The dextrose in the solution reacts with the indigo carmine to slowly change it back to yellow and release the oxygen so the reaction can take place all over again. Eventually the dextrose gets used up and the chemical reaction can no longer take place.



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# Dry Ice And The Pink Liquid

**A pink liquid turns colorless when dry ice is added.**

## Materials needed

1. 2 liters of water containing 2 milliliters of phenolphthalein solution, and enough sodium hydroxide to turn the solution dark pink
2. 100 grams of dry ice
3. a 2000 milliliters graduated cylinder

## Demo

1. Fill the cylinder almost to the top with the pink solution.
2. Add the dry ice to the cylinder. Vigorous bubbling occurs and the liquid gradually turns colorless.

## Hints and notes

1. To avoid splashing do not fill the cylinder to the very top.
2. Handle dry ice with gloves.
3. Use small chunks of dry ice. A large piece resting on the bottom of the cylinder has the potential to crack the bottom of a glass cylinder.
4. Point out that the white "smoke" is water vapor, not carbon dioxide.

## What is happening?

Dry ice is solid carbon dioxide as the ice sublimates the carbon dioxide gas released combines with the water to make carbonic acid. The carbonic acid formed neutralizes the sodium hydroxide in the solution. When the sodium hydroxide is used up the solution becomes acidic, and the phenolphthalein indicator turns colorless.



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# Floating Bubbles

## Soap bubbles float over a layer of carbon dioxide

### Materials needed

1. a 5 or 10 gallon fish tank
2. a piece of Styrofoam™ and a porcelain dish
3. warm water
4. dry ice
5. a bubble wand and bubble blowing solution

### Demo

1. Place the Styrofoam™ in the bottom of the fish tank; this will serve as an insulator and prevent the bottom of the fish tank from cracking.
2. Fill a porcelain dish half way with warm water. Place the dish on the Styrofoam™ in the fish tank. Add the dry ice to the dish.
3. Wait until the tank appears half full of fog. Then blow bubbles across the top of the fish tank so that they fall into the tank. The bubbles will float above the fog.

### Hints and notes

1. The piece of Styrofoam™ insulates the bottom of the fish tank from the very cold dry ice container. Failure to use the foam may result in a cracked fish tank.
2. Do not let any of the soap bubble solution drip into the dish with the dry ice and water. If this happens, carbon dioxide suds begin to fill the tank.
3. Shining a light through the tank can enhance the bubble's visibility.

### What is happening?

The dry ice releases carbon dioxide into the fish tank. The carbon dioxide is heavier than air. The bubbles that are filled with air bounce around on the carbon dioxide layer.



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# Balloon and Skewer

**A bamboo skewer is pushed through an inflated balloon without breaking the balloon.**

## Materials needed

1. a medium size balloon
2. a pointed bamboo skewer
3. soap solution or glycerin

## Demo

1. Partially inflate the balloon. Do not inflate it until it is very taut.
2. Moisten the skewer with glycerin or soap solution. The simplest way is to wipe the skewer with a soapy cloth.
3. Place the point of the skewer near the stem of the balloon and apply gentle pressure while rotating the skewer. The point of the skewer should pierce the balloon. Push the skewer through to the thicker bottom part of the balloon. Again apply gentle pressure while rotating the skewer. The skewer should pierce the balloon.
4. Gently withdraw the skewer and use the point to pop the balloon.

## Hints and notes

1. The demo is tricky and doesn't work every time, either because the balloon is too highly inflated, the skewer is too blunt, or the skewer has a sliver of bamboo sticking out from its shaft.
2. Have extra balloons and skewers available for a second try.

## What is happening?

The balloon is made of a polymer. When the skewer is gently pushed into the surface of the balloon the polymer strands are pushed aside so the skewer can pass through. A quick jab with the skewer does not allow time for this to happen and the balloon breaks.



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# Goldenrod Paper

**A large piece of yellow paper is sprayed with a liquid and writing or an image appears in yellow on a red background.**

## Materials needed

1. goldenrod paper
2. wax candle
3. dilute ammonia solution or dilute sodium carbonate solution (washing soda) in a spray bottle

## Demo

1. Write a message or draw on the goldenrod paper with the wax candle.
2. Spray the goldenrod paper with the ammonia or sodium carbonate solution. The message or drawing will appear in yellow against a red background.

## Hints and notes

1. If an ammonia solution spray is used the image or writing will fade away as the paper dries.
2. If the sodium carbonate solution is used the image will remain when the paper dries.
3. Be careful not to spray the solution toward anyone.

## What is happening?

The yellow dye in the goldenrod paper acts as an acid base indicator. It is yellow under neutral or acidic conditions, but turns red in the presence of a base. Both ammonia and sodium carbonate solutions are bases, so when the paper is wetted with these solutions the paper turns red. Using wax as the writing medium prevents the paper from being wetted by the base spray, and the paper under the wax stays yellow. When the ammonia solution evaporates, the paper returns to the yellow color. When the water in the sodium carbonate solution evaporates the solid and basic sodium carbonate remains on the paper and the red color remains.



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# Fake Snow

**Water is added to a small amount of powder and the container appears to fill with snow.**

## Materials needed

1. 10 grams of fake snow powder
2. 200 milliliters of water
3. large beaker or other colorless transparent container

## Demo

1. Pour the fake snow polymer into the large beaker.
2. Pour the water into the beaker.
3. Shake gently and a fluffy white snow-like material will appear.

## Hints and notes

1. To regenerate the white fake snow powder, spread it on a tray and dry it out in a microwave oven for several minutes.
2. Visitors can touch the fake snow. It is not toxic; but tell them to wash their hands after touching it as a precaution.
3. The fake snow is sometimes used in movies or as base on a ski slope when making snow.
4. The fake snow powder can be purchased from Educational Innovations.

## What is happening?

The white powder is sodium polyacrylate starch polymer that absorbs water and swells when wetted. The manufacturing process is such that the polymer forms flakes rather than a gel when wetted.



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# Ripping a Soda Can in Half

**A small child and an adult are each asked to rip a soda can in half. The child does it easily, the adult has great difficulty.**

## Materials needed

1. several empty soda cans
2. 1 molar copper (II) chloride solution  
(dissolve 100 grams of copper (II) chloride in a liter of water)
3. Several soda cans prepared in the following way:  
Use a small triangular file to make scratch around the inside circumference of the can about half way down. The idea is to scratch a circle around the inside of the can to remove the can's plastic coating. The scratch must go completely around the can. Then remove the pull-tab from the can so it will be easy to identify later on. Now place the can in a plastic container and fill the can with the copper chloride solution. The plastic container is used to prevent a mess if the reaction goes too long and destroys the can or creates a leak. Wait about 3 minutes and empty the copper chloride solution back into the stock bottle. (It can be used several times). Rinse out the can with water and it is ready to use in the demonstration.

## Demo

1. A child and an adult are each given a soda can and asked to rip it in half.
2. The child can easily do it, but the adult finds it difficult.

## Hints and notes

1. Have the child wear gloves because the torn can may have sharp edges. Tell the child to grab each end of the can and twist.
2. Take care when handling copper chloride it is moderately toxic and a skin irritant.
3. If the copper chloride is left in the scratched can too long, the can will come apart when handled in any way.

## What is happening?

When the can is scratched the plastic coating covering the inside of the can is removed and the aluminum is exposed. The copper ions in solution react with the exposed aluminum. A thin copper layer that has no structural strength replaces the aluminum. The can is only held together by the paint on the outside of the can and can easily be torn apart.



# Luminol

**Two liquids are combined in a spiral tube and the tube glows with a blue light.**

## Materials needed

1. 100 milliliters of Solution A:  
Take 500 milliliters of distilled water, add 4 grams of sodium carbonate and .2 grams Luminol. Stir until dissolved. Then add 24 grams of sodium bicarbonate, 0.5 grams of ammonium carbonate, 0.4 grams of copper sulfate, and dilute to 1 liter with distilled water.
2. 100 milliliters of Solution B:  
Dilute 50 milliliters of 3% hydrogen peroxide to 1 liter with distilled water.
3. a funnel attached to long piece of flexible clear plastic tubing that is wrapped around in a spiral
4. a small beaker to catch the liquid after it runs through the tubing

## Demo

1. Pour small amounts (10-20 milliliters) of luminol demo solutions A and B into separate containers.
2. The room lights are turned off.
3. Pour both mixtures simultaneously into the funnel attached to the spiral tubing at the same time. Blue light appears in the liquid that runs through the spiral.

## Hints and notes

1. The two solutions are fairly stable and may be kept for several weeks.

## What is happening?

When the two solutions mix, a chemical reaction occurs that causes light to be emitted. A similar reaction takes place in fireflies when they light up.



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# Dropping Bubbles

**Large opaque soap bubbles drop from the end of a faucet-type tube.**

This demonstration requires the construction of a faucet shaped apparatus out of PVC pipe and 2 liter soda bottles. The directions for constructing this apparatus can be found in *Twenty Demonstrations to Knock Your Socks Off Vol.1* by Bob Becker published by Flinn Scientific, Inc.

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## References

Chen, P. (1974). *Entertaining And Educational Demonstrations*, Chemical Elements Publishing.

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Shakhashiri, B. (1983) *Chemical Demonstrations: A Handbook for Teachers of Chemistry*, volume 1-4. University of Wisconsin Press.

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