

“Simple”y the Best Demos

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The best way to have students understand concepts is to have them do experiments, unfortunately it is very time consuming and costly. If they could spend all their time in the lab, the students would learn a very few concepts, but very well. The next best thing is to show them through demonstrations. but as with laboratory work, it can be expensive for exotic reagents. Also, we must deal with the ever increasing lists of chemicals which were once commonplace, which have been pulled from our shelves, most legitimately, but a few because administrators with little chemistry knowledge are very nervous. Beginning in 1987, I had to deal with this and find a way of teaching with budgets of a low as \$150.00 for eight sections of chemistry. Therefore, I have been creating, collecting and modifying laboratory experiments and demonstrations to give my students an excellent, challenging chemistry course and still fit my budget. These are some of my favorites. I have also included some of the outstanding advise I have been given in my 35 years of teaching

Like all good teachers I am always learning. I have been fortunate to learn from some of the best chemistry teachers around. People like Reg Friesen, Irwin Talesnick, Andy Cherkas, Doug DeLaMatter Bassam Shakhashiri, Jerry Bell, George Stevens, George Hague, Ed Escadero, Val Wilcox, David Katz, Paul Kelter, Pat Funk, Frank Huss, Bill Marks, Harvey Gendreau, Kathleen Skelly, Bob Becker and the Weird Science group plus many, many more, (I apologize for all of those I may have inadvertently left out), all of whom I am also proud to have as friends. Thank you to all of those fabulous people who have helped me become a good demonstrator and better teacher. This is dedicated to all of you.

“Simple”y the Best Demos

- 1.* **FLASHY WATER JUG.** To a round 5-gallon spring water jug (they fit into water coolers), add 10-15 mL of ethanol and swirl to fill with vapor. In front of the students, empty the excess out. Turn out the lights and toss a lighted match into the jug and stand back. Pour out the “unknown” liquid product out and then try to relight. predicting products, writing and balancing reactions, exothermic reactions, organic, photosynthesis density
- 2.* **DENSITY BOWL:** Place an 8 lb. Bowling ball in an aquarium. Observe. (Then use a >12 lb ball, to compare) density
- 3.* **MAGIC CANDLE:** Before class, fill a 400 mL beaker 2/3 full of water. Repeat in a second beaker using isopropyl alcohol. In front of the class break a candle into 2 uneven pieces. Put the smaller end into the isopropyl alcohol and the larger piece into the water. Observe. density
- 4.* **THE TORTOISE AND THE HARE:** Add 150 mL of equi-molar acetic acid and HCl into two 250-mL Erlenmeyer flasks (one acid in each flask). Into each of 2 balloons, place 50 cm of Mg ribbon. Carefully, without letting the Mg leave the balloon, cover the mouth of the flasks with one balloon per flask. Simultaneously, lift the balloons, allowing the Mg to fall into the flasks. rates, strengths of acids
- 5.* **A VOICE ACTIVATED REACTION.** Add 1-2 drops of phenol red indicator to 250 mL of water in a flask. Add 1 drop 1M NaOH to produce a red solution (phenol red is red at pH 8.5 and yellow at pH 6.8). Announce to the class that this reaction can be activated by the voice, if the person has just the right voice! Direct each student to remove the stopper, speak into the flask to speak to the solution, stopper the bottle and give it a quick swirl. reactions, acids-bases, respiration
- 6.* **IT MAKES WATER?** Using two beakers, add 50 mL 3% hydrogen peroxide to one and an equal amount of water to the other. Add 5 mL 0.1M Fe(NO₃)₃ to each. The water turns yellow, while the H₂O₂ turn brown and fizzes (use a glowing splint to test for O₂) and eventually turns to yellow. reactions, rates
7. **HOW DOES YOUR CREDIT CARD GLOW:** Electromagnetic Spectrum
Part 1: Shine a credit card (AmEx, VISA, etc.) under a UV light. Look for the imbedded words. the newly re-formatted US or Canadian money (\$5's, 10's, 20's, etc.) also have a UV strip imbedded in them.
Part 2: Use the UV light to show the UV reflection of common materials (ie: tonic water, or Tide™ detergent) Now, spray the bottom of a petri dish with colorless sun-block lotion/ Hold one of the reflective materials over the petri dish. Shine the UV light through the petri dish, towards the material. No reflection!
- 8.* **MOUSSE LIGHTS:** Make a circle on a fire-resistant surface with hair mousse. Turn off the room lights, and light the mousse. Safety
Flamability
- 9.* **WE DON'T NEED NO STINKING GOGGLES:** Fill a pie pan with shaving cream. While your goggles are on (and discussing safety), have someone (an administrator works really well) give you the “pie in the face”. Lift off your goggles. Safety
10. **RED EYE:** Draw an eye on a piece of acetate and place on the overhead. Cover with a another piece of acetate in the shape of a contact lens. Drop 2 or 3 drops of red food coloring on the edge of the “contact lens”. Wait and watch the capillary action. Drop water onto the lens. Safety
11. **EYE SAFETY:** Draw an eye on the bottom of a petri dish and place on an overhead projector. Add an egg white into the dish. Add some strong acid. The egg white clouds up, simulating what an acid would do to one's eye. A base is dropped onto the spots where acid has been added to simulate what happens when someone tries to “undo” the damage that acid caused. Safety
- 12.* **FUNNELING AHEAD:** On a ring stand, set up three funnels of different delivery sizes, one over the other. Pour colored water through the three. Rearrange them and repeat. reaction mechanism, rate determining step
13. **ABSORPTION IN PAMPERS.** Hold an ultra- diaper in your hand and arm. Proceed to pour water onto the diaper until it starts to spill. It will hold 1 liter or more! Polymers
- 14.* **GREY BLOCK:** Glue a piece of Al foil between 2 blocks of GulfWax (canning wax) so that the foil is undetected. Show the wax block, showing that the grey half is always on the bottom. From the bottom, shine a flash light to light the bottom. Light
15. **THE CAN RIPPER.** Score the inside of a soft drink can with a triangular file in order to tear the plastic lining. Add a solution of CuCl₂ (or acidified CuSO₄) until just above the score. Wait 15 minutes, then pour out the solution, which can be reused, and rinse the can with water. The can is now held by just the paint and will easily tear apart. I usually give my “strongest “ student an untreated can and my “weakest” student the treated one just for some fun. redox

- 16.* **POWER WRITING:** Wrap a 15 cm² piece of cardboard with Al foil. Tape a piece of filter paper which has been soaked in KI(aq) and phenolphthalein onto the Al foil. Connect the foil to one terminal of a 9-V battery. Write on the filter paper with the other terminal. Reverse wires and repeat. electrochemistry
- 17 **THE SUSPENDED PAPER CLIP.** Suspend a cow magnet (available from feed stores) with a string from a ring on a ring stand. Tie a paper clip on a thread long enough to be about 1 cm from the magnet and the other end taped to the bottom of the stand. Bring the paper clip towards but not touching the magnet and let it be suspended by itself. bond forces
18. **LEMON JUICE BLOW-UP:** Place a balloon around stem of a funnel. Put 1 spoonful (about 5 g) of baking soda into the balloon. In a small bathroom cup (3 oz), mix equal amounts of lemon juice and water and pour into bottle. Place end of balloon around neck of bottle. Let baking soda fall into bottle and observe. Variation: The carbon dioxide balloon can be ignited to compare the property of carbon dioxide gas with that of hydrogen gas. The carbon dioxide does not ignite and does not therefore make a loud bang as compared to the hydrogen balloon. Gases, acid-base reactions
19. **POTATO GUN.** Take a 0.70-meter length of approximately 1-cm diameter pipe fitted with a wooden dowel of 1.0-meter length. Put a rubber stopper a hand's-width from the end. Load the "gun" with a plug of potato and push it down about 1/3 of the way down, then add another potato plug at the end to give a fixed volume. Place dowel inside the pipe from the bottom, aim and fire! gases, Boyle's Law
20. **GAS LAWS FOR DUMMIES:** Using a long (about 1 meter by 10 cm wide) piece of cardboard, write a large "T" in the middle, a large "P" on one end and a large "V" on the other, using a thick, dark magic marker. Put a hole through each letter large enough to place a pencil through. Show the gas relationships Gas laws
21. **Excuuusssse Me:** Take a large swallow of a cold carbonated soda. Let out a very loud burp. Solubility of gases
- 22.* **SOFT DRINK COLIC.** Attach a blind nipple to a baby bottle. Fill with 12 ounces of any soft drink at room temperature. While pointing the nipple away, shake. (Blind nipples may be gotten from the Evenflo Company, 1-800-356-BABY, tell them you are a science teacher OR at pet supply stores in the area for puppies or kitties) Henry's Law
23. **500. + 500. =?** Mark the line on a 1.0-liter volumetric flask with a black electrical tape. Add 500.0 mL of 2.0M HCl to the flask. Slowly, with swirling, add 500.0 mL of 2.0M NaOH to the flask. The level of the total solution will be above the liter mark! The increase in volume is partly due to thermal expansion, but once it has cooled the increase is still very noticeable. The solution is above the mark by about 18 mL! This is due to the formation of 1 mole of water during neutralization solutions, gases, nutrition
24. **MOM TO THE RESCUE:** To 100 mL of milk of magnesia in a 500 mL beaker on magnetic stirrer, add 200 mL water and a few mL's universal indicator. With stirring, add small amounts of 3M HCl until acidic. Watch and discuss. neutralization, thermal expansion, solutions
25. **I-SO-TOPE SO:** Fill three or four tennis balls with about 15ml water using a hypodermic syringe (from a friendly pharmacist). Add these balls to a dishpan which also contains several normal tennis balls. Shake to get the balls bouncing out of the pan. The heavier isotopes will remain in the pan isotopes
26. **INSTANT RUST:** Use 000 steel wool. Weigh a piece of steel wool on balance, place steel wool into a flame and let completely react. Reweigh conservation of mass, reactions, equations
27. **POPCORN SWITCH:** Hide a ping pong ball in a container of unpopped popcorn. Place a steel ball on top. Cover the container and shake vigorously. Density Molecular motion
28. **THE POWER OF ICYou:** Paint a piece of paper with tincture of Iodine. Spray with laundry "spray starch". Use a vitamin C tablet to write on the paper. Discuss redox
- 29 **"HOLE"Y WATER:** Put two small holes (about the diameter of the lead in a pencil) on one side of the bottle, one near the bottom and the other about the middle of the bottle. Put a piece of tape on each of the two holes. Fill the bottle with water. Screw the cap back onto the bottle. Take the tape off the first hole closest to the bottom of the bottle. Observe. Now unscrew the cap. Observe. Screw the cap back on again. Uncover the next hole, observe what happens. Unscrew the cap, observe. pressure
- 30.. **SELF SEALING BAG:** Fill a zipper sandwich bag with water. Zip it closed. Quickly poke a sharpened pencil through the bag. polymers
31. **KOSHER DELIGHT:** Separate electric cord, exposing the wire. Connect each side to a large nail. Assemble a fresh, whole Deli pickle onto a ring stand, inserting the nails into each end. When and only when this is complete, plug the cord into a power source. electrolysis