

## An Inexpensive Kit for Conducting Fluid Demonstrations for Middle School Teachers

*This guide was prepared by Stan Cutler during his participation in the 2012 Deep-C “Research Experiences for Teachers” program. Mr. Cutler a high-school physics teacher in Altamonte Springs (near Orlando), Florida.*

The kit pictured below costs about \$20 to assemble, and enables the instructor to perform numerous fluid demonstrations (most of the included demos use liquid fluids, but remember, gases are also classified as fluids!). Contents include vegetable oil, rubbing alcohol, glycerin, antacid tablets, dishwashing soap, medicine dropper, sugar, salt, corn starch, molasses (or honey), food coloring, powdered milk, and a couple of physics “toys” (tornado tube, water wheel). Other materials (water, 2-liter soda bottles, glass jars, penny, eggs, etc.) can easily be “scrounged” from home!



The following demonstrations/activities can all be done using the contents of this kit. A brief description of each demonstration is included, but the instructor can easily modify the lessons and run them as inquiry activities, “discrepant events,” or even full labs.

## Recommended Demonstrations:

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**Suspended Egg** (buoyancy; source 1). Set up one jar with water, another with a two-layer solution, less dense over more dense. Salt water and fresh water work well. Add an egg (or potato) to each tank. Discuss buoyant forces.

**Underwater Volcano** (buoyancy, ideal gas law, diffusion; 1). Lower small bottle with hot water and dye to the bottom of a larger tank filled with cool water. Observe the rising/spreading dye and discuss.

**Broken Pencil** (refraction, two-layer system; 1). Set up jar with a two-layer solution, less dense over more dense. Put pencil in water. Observe from side and discuss why the pencil appears to be “broken.”

**Water Fireworks** (density, scientific theories; 2). Mix some oil and food coloring (stir well). Pour into a glass of chilled water. Observe the coloring sinking, the oil floating, and the fireworks pattern being created. \*This is set up as an inquiry lesson, and I obtained the book of activities through attending Dr. Chew’s inquiry workshop, which I highly recommend!

**Milk Explosion** (surface tension, chemical reaction between milk and protein; 3). Pour a small amount of whole milk in a tray or dish and add a couple of drops of food coloring. Dip the tip of a cotton swab in some liquid soap and then touch it to the milk. Discuss the interesting reaction, and how the detergent lowers the surface tension of the fluid. See the same source for additional demonstrations.

**Floating Paper Clip** (surface tension; 4). Carefully place a paper clip on the surface of a container filled with water (using a fork might help). Add one drop of dish soap and watch the clip fall. Discuss (and tie in to dispersants used in oil spills). Numerous other demonstrations with this source.

**Floating Soda** (density; 5). Fill a large container (aquarium) with water. Place unopened cans of Coke and Diet Coke in the tank. Observe and discuss why the Diet Coke floats and the regular Coke sinks. This source contains a few other density demonstrations.

**Tornado Tube** (vortex; also called Cyclone tube). Fill a 2-liter plastic bottle about 2/3 full with water (can add food coloring). Use the tornado tube attachment (available from multiple sources; I bought mine for under \$2 from the Challenger Learning Center in Tallahassee) and connect a second 2-liter bottle. Tip upside down, swirl the bottles, and observe the beautiful “tornado” that occurs. Discuss the places in nature where a vortex can be observed (water in drain, toilets, tornadoes, blenders, heart pumping, etc.).

**Drops of Water on a Penny** (surface tension). Use a medicine dropper to carefully add drops of water on the surface of a penny. Most students will predict that the penny will only hold a few drops before “overflowing,” but you should be able to get over 30.

**Ooblek** (non-Newtonian, dilatant fluids, viscosity). Mix approximately 2 parts cornstarch to one part water (add food coloring for colored ooblek). The viscosity of this mixture will increase the faster it is deformed, which can be tied in to research on body armor that can stop knives or bullets.

**Make an Easy Lava Lamp** (density, chemical reactions; 6). Pour water into an empty plastic bottle until  $\frac{1}{4}$  full. Pour in vegetable oil until bottle is nearly full. Add some food coloring and observe. Cut an antacid table into small pieces and drop in the bottle. Watch the rising carbon dioxide bubbles and the falling colored water. Keep the cap (try shaking the bottle with the cap on), and recharge later with more antacid tablets.

**Bubble-ology** (surface tension; 7). Mix approximately 8 parts water to 1 part detergent. Add a small amount of glycerin, make a “pipe cleaner wand” (or something similar), and blow your bubbles. You could alter the experiment by leaving out the glycerin, or by substituting something like corn syrup for the glycerin. This source has a lot of ideas for Science Projects!

**Layering** (density). Various liquids, when poured in a container, will separate into layers based on their different densities. You have all the liquids, and food coloring, so try it yourself!

**Fluid “Toys.”** In the picture of my kit, you can see a “water wheel” in the front right (which is actually filled with oil). My students are fascinated by this, and will spend all class playing with it if I let them (it is a lot more interesting than I am!). I recommend purchasing a couple of “toys” that work due to fluid principles like density, buoyancy, and surface tension. My water wheel cost about \$4 at the Challenger Learning Center.

## References

- 1) **Simple Experiments in Fluid Dynamics.** Developed by Aaron Paget with support from the Geophysical Fluid Dynamics Institute, Florida State University.
- 2) **7<sup>th</sup> Grade Science Inquiry Activities.** Larry Chew, Ph.D, Inquiry Institute. [www.inquiryinstitute.org](http://www.inquiryinstitute.org)
- 3) **Science Projects with Dishwashing Liquid.** Sarah Lipoff, eHow Contributor, [www.ehow.com/list\\_6021780\\_science-projects-dishwashing-liquid.html](http://www.ehow.com/list_6021780_science-projects-dishwashing-liquid.html).
- 4) **Forty Demos to Make Science Come Alive.** Presented by Nebraska Educators Really Doing Science (N.E.R.D.S.) at NATS. [www.theteachersguide.com/Sciencedemos1.htm](http://www.theteachersguide.com/Sciencedemos1.htm)
- 5) **Density Lesson Plans for Middle School.** Amanda Milner, eHow Contributor. [www.ehow.com/info\\_10025276\\_density-lesson-plans-middle-school.html](http://www.ehow.com/info_10025276_density-lesson-plans-middle-school.html)
- 6) **Science Experiments for Kids.** Make an Easy Lava Lamp. [www.sciencekids.co.nz/experiments/easylavalamp.html](http://www.sciencekids.co.nz/experiments/easylavalamp.html)
- 7) **Bubble-ology.** Science Buddies: Free Science Fair Project Ideas, Answers, & Tools for Serious Students. [www.sciencebuddies.org/science-fair-projects/project\\_ideas/Chem\\_p025.shtml](http://www.sciencebuddies.org/science-fair-projects/project_ideas/Chem_p025.shtml)

*The Deep-C “Research Experiences for Teachers” (RET) program was made possible by a grant from BP/The Gulf of Mexico Research Initiative.*