Overview

...They're all about the liquid! Students know a lot about liquids from exploring them in their daily lives: drinking water, playing in a lake or pool, helping wash dishes, and so on. They've also had opportunities to experiment with solids and liquids in the first few years of school. In this activity, we'll ask students to think about liquids in a slightly different way as they make, explore, and observe square bubbles. Students will focus on the behavior of molecules at the microscopic level, and will start to determine how this gives rise to the properties of liquids that we see and use everyday.

Theory

The molecular behavior of liquids allows them to flow and take the shape of any container, and also makes them incompressible. The molecules in a liquid are more energetic than when they are a solid, so they can move more. The molecules in a liquid are bonded to some neighboring molecules, but they can also slide past other molecules. This reduced bonding and increased movement at the molecular level result in liquids flowing and taking the shape of containers at the macro scale. Water is a special liquid in large part because its molecules are particularly “sticky” in bonding with one another. When water is in its liquid state, the molecules pull themselves into the tightest situation possible: a sphere. We see this in droplets of water on leaves after rain and in raindrops (which are really more spherical than teardrop-shaped).

With the square bubble makers in the States of Matter kit, you can observe another special property of liquid water: its ability to stick to other types of molecules and surfaces, stretching and creating a film. Students will marvel at this interesting aquatic phenomenon as they make square bubbles.

Doing the activity

Preparation before class: Check that all of the bubble makers are properly assembled, as shown in the image above and described caption. Set up a bubble-dipping station in a central location in your room, but don’t pour the bubble solution out of its bottle yet (if you only have concentrate, do make a properly-diluted bottle at this point) — you will be using this when you first talk to your class about the lesson. Depending on the layout and furnishings of your room, you may need to make preparations to prevent students from slipping on bubble solution that falls to the floor, and/or protect your carpet from spills. Members of your

Necessary materials:

- 6 square bubble makers
- 1 bottle of bubble solution*
- 1 rectangular container for dipping square bubble makers
- funnel to use when pouring the bubble solution back into the bottle
- plastic plates or plastic-coated plates
- straws
- cloth or paper towels for spills

*The bubble solution we use is called beeboo. It is a concentrate — 1 bottle makes a gallon. We are able to buy it on Amazon.com.
school’s custodial team may be able to help with a tarp, towels, or other creative ideas. Alternatively, if the weather is nice, you could consider doing this activity outdoors.

With your class: Pull your students together and tell them that they’ll be working with bubbles. Elicit students’ prior knowledge about bubbles. What have they experienced or observed when using bubble solution, hand soap, dish soap? What ideas do they have about what might cause the observed properties? Record students’ ideas on a whiteboard or large piece of paper.

Now, help students carefully observe the bubble solution as you get ready for the activity. Show students the bottle of bubble solution, and ask some questions about it. Where does the solution sit in the bottle? (It settles to the bottom.) What if I tip the bottle sideways? (Now the solution spreads out more on the low side of the bottle.) Does it take the shape of the container? (Yes!) Now, tip the empty rectangular container slightly, and carefully pour the bottle of bubble solution in; pour slowly to avoid making tiny bubbles within the solution. What is happening to the liquid now? (It’s getting poured into the container. That’s right! You can pour liquids because they flow.)

Show students the square bubble makers and explain that they have one bubble maker per group. They will work together, making observations and suggestions as a group, but each student should have equal turns to experiment with the bubble makers. Demonstrate using the bubble maker: Use the handle to put it in the square canister, ensuring that the bubble maker is completely submerged in the bubble solution (all sides of the bubble maker need to be covered with solution).

Send students to their small group areas with a bubble maker, straws for each person in the group, and some paper towels to clean up spills. They should choose one person from each group to come over to the bubble stations and dip the bubble maker into the canister. Have each person with a bubble maker put a plate, with a tiny bit of solution on it, underneath the bubble maker to keep the solution from dripping on the floor.

Facilitate small group exploration until all students have had enough time to work with the bubble makers, then call on groups to share some of their findings. Here are some things that students might have discovered, or if they haven’t noticed yet, that you can suggest they try:

- What shapes can you make or discover in the bubble maker? (Triangles, squares, spheres, and unusual bubble shapes with edges.)
- Can you break some of the bubbles and get different shapes?
- Can you blow bubbles inside the bubble maker with a straw?
- Can you make a square in the middle of the bubble maker? (Yes, you can do this using the straw.) Is there a way to make the square bigger? How about making it smaller?
- Try putting your finger into the bubble. Can you figure out a way to do this without making the bubble pop?
- What do you notice about the colors? What color do the bubbles turn right before they pop?

A square bubble setup very similar to the one in the above image, except someone has used a straw to create a square bubble at the point where the vertices used to meet. The person has poked their right index finger into the middle of this square bubble (this can be done by first coating your finger in bubble solution).
Summing up
This is a wonderful exploration students can take on to discover some of the special properties of liquid water.

For more information
Little Shop of Physics: https://www.lsop.colostate.edu
Colorado State University College of Natural Sciences: https://www.natsci.colostate.edu