Soap Bubbles

Create geometric art with soap films.

Color Light Waves

Using pipe cleaners and drinking straws, you can make three-dimensional geometric frames: cubes, tetrahedrons, or shapes of your own design. When you dip these frames in a soap solution, the soap films that form on the frames are fascinating and colorful.

materials

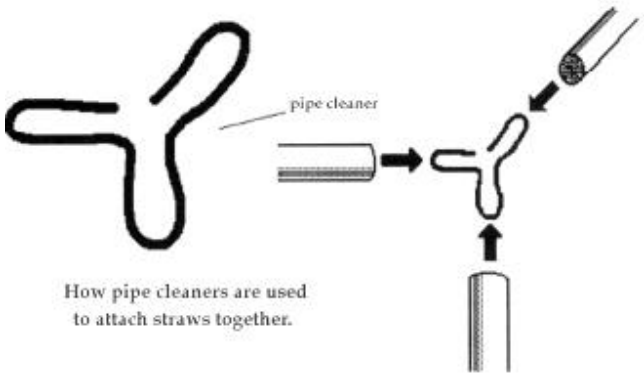
- **Plastic drinking straws.**
- **Pipe cleaners** (available at school supply, hobby, or party stores).
- **A small bucket** or container for the bubble solution. The container must be large enough so that bubble frames are entirely covered when they are dipped.
- **Bubble solution** (You can use a commercial solution like Wonder Bubbles™, or use the Exploratorium's recipe: To each gallon (3.8 1iters) of water add 2/3 cup (160 ml) of Dawn™ or other dishwashing liquid and 1 tablespoon (15 ml) of glycerine, available at your local pharmacy. Bubble solution works best if it is aged at least a day before use.)

assembly

(30 minutes or less)

Form frames using the drinking straws for the straight pieces. Connect two straws at a corner by inserting a doubled pipe cleaner into the end of each straw. In places where three straws meet, fold the pipe cleaners as shown in the diagram. Attach a pipe cleaner handle to your frame.

Try constructing cubes or tetrahedrons, or just let your imagination run wild. Mix the soap solution in the bucket. Make sure that you have enough solution to fully cover the frames when they are dipped.



How pipe cleaners are used to attach straws together.

to do and notice

(15 minutes or more)

Dip the frames into the soap solution, and observe the fascinating geometrical shapes that the soap films form. Also notice the shimmering colors in the soap film.

what's going on?

As you lift your frame out of the solution, the soap film flows into a state of *minimum energy*. The soap film is in a state of minimum energy when it's covering the least possible amount of surface area. The intricate shapes you see inside the frame represent the minimum area the soap film can cover. You may notice that a soap film will sometimes take on different shapes when you dip the frame into the solution again and again. That's because there may be more than one way for the soap film to form a minimum surface area.

When light waves hit the soap film, they reflect and interfere with each other. This interference causes the shimmering colors you see. White light is made of many different colors. When white light shines on the soap film, some light waves reflect from the front surface of the film and some reflect from the back surface of the film. When these two sets of reflected waves meet, they can add together, cancel each other out, or partially cancel, depending on the thickness of the film and the initial color of the light. When light waves of a particular color meet and cancel each other, then that color is subtracted from white light. For example, if the red light waves cancel, then you see white light minus red light, which you perceive as blue-green light.

etcetera

Plastic bar straws, which have a smaller diameter than regular drinking straws, hold the pipe cleaners more tightly. But bar straws are more expensive and are sometimes harder to get. If you can't find them at grocery or liquor stores, try restaurant or party supply stores.

Questions? Comments? Want to share your results?
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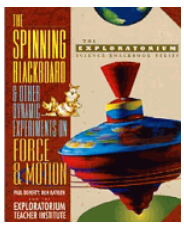

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