



# explora!



## The “Best Bubble”

### What You’ll Need:

- Liquid soap - try a few different types or brands (make sure they are safe for your skin)
- Things to add: glycerin, corn syrup, food coloring, scented oils, like lavender
- Several plastic tubs, like yogurt or to-go food containers
- Bubble wands
- Water

### Here’s What to Do:

- Describe what you mean by “best bubble.” Chances are, ‘the best’ might mean different things to different people.
- As you discuss, consider color, how long it lasts, size, reflectivity, stickiness, and more.
- Mix up some different mixtures of water, soap, and other ingredients listed under ‘things to add.’
- How many different kinds of bubbles can you make?



### What’s Going On?

Soap makes bubbles easily, because each soap molecule has a water-loving, or *hydrophilic* end, and a water-repelling, or *hydrophobic* end. These molecules form a layer that can be filled with air like a balloon.

Your “best” bubble depends on the *solution*, or the mixture of water and other ingredients, that you create. Bubbles that last a long time have a low *surface tension* that keeps the bubble from popping. Glycerin in the bubble solution slows the *evaporation* of the water.



Photo credit Brocken Inaglory

### Career Connections

Bubbles can be used to learn how gases and liquids move. The study of how fluids behave in movement is called **fluid dynamics**. Engineers, meteorologists, oceanographers, and more use fluid dynamics to better understand the world.



## Feel the Heat!

### What you'll need:

- Medium plastic container, like a yogurt tub or to-go container
- Ice and water
- Various objects made of different materials: crayon, pencil sharpened at both ends, plastic spoon or straw, metal spoon or wire, wooden spoon or stick
- Tape
- Stopwatch or timer

### Here's what to do:

1. Use tape to secure each utensil to the inside of the container so they stick out at equal heights.
2. Fill the container with equal parts ice and water, so the bottom of all utensils are submerged. Keep the water level below the tape, so it doesn't unstick.
3. Ask: which objects will be the first to become cold?
4. Once every minute, touch the top of each object. Write down which ones feel cold. Which objects became cold the fastest? Was this your prediction?

### Now try this!

Try the same experiment by filling different kinds of cups (plastic, metal, glass, ceramic, wood) with ice. Make a prediction - which ones will feel cold the fastest? Time how long it takes for the rim to feel cold.

**The science behind it:** Heat is a kind of energy given off by atoms, resulting in heat transfer from one object to the next. When you feel that something is cold, it is because your body's heat is leaving your hand and moving into the cooler object. When heat moves from one object to another, it's called conduction. It's easier for heat to move into certain materials. Materials that don't allow heat to transfer very quickly are *insulators*.

**Connections to everyday life:** Heat transfers through air and water - but one conducts heat better than the other. An insulated jacket (insulation is filled with air) keeps heat near your body, while a cold swimming pool moves heat away from you, because water is a better conductor. How could you test this?



## Racing a Vortex

### What you'll need:

- Two soda bottles of the same size
- A washer with an outer diameter the same size as the mouth of the soda bottle
- Water
- Duct tape
- Food coloring or glitter (optional)

### Here's what to do:

1. Remove the labels on the soda, so you can see inside the bottle.
2. Fill one of the bottles half- to three-quarters full with water. Add glitter or food coloring if you like, but make sure you can see through the water.
3. Place the washer on top of the bottle, then use the duct tape to attach the mouth of the second (empty) bottle on top of the first. Be sure to seal it tightly to prevent leaks!
4. Turn over the bottle; how does the water move?

### Make it a Challenge!

- Once the water has drained from the vortex bottle, try it again - this time shaking the bottles first. What happens?
- Take two regular soda bottles of the same size and fill them with water. Then, challenge a friend to see who can empty their bottle the fastest. What techniques work to make the water drain faster?



Photo courtesy of NSSL

### What's Going On?

When **fluids** begin to spin around a central point they can form a **vortex**. These spinning forces can be very powerful, such as a tornado or whirlpool. Vortexes also form behind a boat as it sails across a lake, and off of the wings of an airplane or a bird as they fly through the air.