Make GIANT bubbles and learn about bubble science!

Materials needed

Included: Giant Bubble Concentrate, 4 Garden stakes, 9 feet of Chunky wool blend yarn, 2 large metal washers or nuts Not included: large plastic bucket or bin; Water

VIDEO INSTRUCTIONS at SciWorkshop.org/KITS

Make two bubble wands - one big, one small. Which one do you think will produce the largest bubbles? Longest bubbles? Longest lasting bubbles?

1. Take one piece of yarn and pass the two ends through a metal washer. Tie a knot.

2. Arrange the yarn loop in an equilateral triangle (three sides of equal length) with the washer at the bottom point.

3. Attach the side points of the triangle to the top of the two poles. You can tie them or use a girth hitch. Reinforce with a Zip tie if needed. Make sure the loop is continuous with no gaps.

(try video instructions if you need help)

Make giant bubble solution

1. Measure one gallon of water into a *clean* plastic bin or bucket. Add the giant bubble concentrate. Mix thoroughly and gently so no froth forms.

2. If possible, let the bubble solution sit overnight - it works much better the next day. Use the instructions on the next page to try your hand at blowing giant bubbles!





Bubbles are amazing! How do they work?



How do bubbles form perfect spheres?

Surface tension! Water likes to sticks to itself and that force pulls the bubble into the shape with the smallest possible surface area – a sphere!

What causes the swirly rainbow colors?

White light from the sun shines onto the surface of the bubble. Light reflects from both the front and the back side of the thin soapy film. The reflected light waves interact and either combine together or cancel each other out. This results in different colors reaching your eyes. The colors constantly change as the soap film changes thickness! This is the same reason why a thin film of oil on a puddle is rainbow colored.

What are giant bubbles made of?

First off, you must have soap and water. Water alone sticks to itself so strongly that it will not form a bubble.. Adding soap lowers the water's surface tension allowing it to spread out. Soap sandwiches the water it in between protective layers. That slows down the rate of evaporation and keeps the bubble from drying out and popping. The secret ingredient in your giant bubble solution is a polymer called *polyethylene oxide*. The polymer makes the bubble surface more elastic so it can stretch and deform without breaking.

If you like bubbles, keep experimenting! Try different bubble recipes, different wand materials...

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TIPS AND TRICKS To blow giant bubbles:



1) Bring your watered down bubble mix and wands outside to the yard or park. Stir thoroughly and *gently*.

2) Dip the wand into the bucket and let all the yarn soak3) Lift the wand out of the bucket with the handles together so that the loop is closed.

4) Let the excess bubble mix drip into the bucket

5) With your back to the wind lift the bubble wand *up high* and *pull your arms apart to open the loop*

6) Let the wind blow the bubble for you. If there is no wind, walk backwards to push air into the soap film

7) Practice bringing the handles back together to "close" the bubble so it can float away

8) When yarn loop is empty, close and open it again to reestablish the bubble film

9) After a few bubbles you will need to dip the wand into the bucket again. Be careful to keep your wand clean. Don't let it touch the ground – even tiny bits of dirt can pop bubbles
11) When you are all done, store any extra bubble mix and let your wand air-dry for use another day

The right conditions make a **huge** difference! Bubbles pop when they are dehydrated (dry out), the force of the wind is too strong, or they hit a dry object. Bubbles like cool, wet, overcast days. Try giant bubbles in the shade or on a cloudy day. Right after it rains the air has high humidity and the bubbles will last longer. If there's a strong wind, wait until it dies down or there is only a gentle breeze. Go to a spot with lots of open space where your bubbles won't run into objects.

Have you ever gotten soap in your eyes? It hurts! Don't run face-first into giant bubbles to pop them, or spin around with a drippy bubble wand.

These bubbles have a special polymer in them that keeps them from drying out so fast. It also makes them super slimy! Try to avoid dripping or spilling the solution on the ground. If the ground gets slippery move to a new spot.

Deeper dive into Bubble Geometry: The surface tension in a bubble's skin pulls the bubble into the smallest possible surface area for its volume. Below see how the *same* volume of air, one cubic inch, has a *different amount of surface area* depending on the shape!

\wedge	Shape	# of sides	Volume	Surface Area
	Tetrahedron	4	1 cubic inch	7.21 square inches
	Cube	6	1 cubic inch	6 square inches
	Octahedron	8	1 cubic inch	5.72 square inches
	Dodecahedron	12	1 cubic inch	5.32 square inches
	Icosahedron	20	1 cubic inch	5.15 square inches
	Sphere	infinite	1 cubic inch	4.84 square inches

https://www.exploratorium.edu/ronh/bubbles/shape_of_bubbles.html

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Bubbles in Nature



Aquatic mammals use bubbles for hunting, communicating, and playing. Humpback whales blow walls of bubbles (called "bubble nets") to herd schools of fish into one spot and swallow them. Seals blow bubbles as a warning signal when defending their territory. Dolphins are much like you - they like to blow bubble rings, just to play with!

Barry Bland Photography

Whalingmuseum.org



Imagine living inside a home made out of bubbles. Young Spittlebugs eat the sap of plants and live inside of a bubble shelter. Their frothy fortress insulates them from the cold and heat and hides them from predators.





The Diving Bell Spider lives most of its life underwater. It uses hairs on its abdomen to gather air at the surface and adds it to a big air bubble cocconed in silk.

Gerhard Schulz/Getty Images