Super soap bubbles

Area of Science: Physics
Meant for Grade 7-9 (age 11-13).
This experiment is inedible.
An adult should be present.

Overview:
Learn about surfaces that soap bubbles form

Equipment:
Glycerin, water, liquid dishwashing detergent, wire.

Safety:
Don't spill it on the rug or furniture.

How to do the experiment:
The recipe used for the Science festival was 14 cups water + 1 cup Ivory concentrated dish detergent + 2 table spoons of glycerin. The recipe in this experiment would be VERY expensive, but might be good for a very small batch of long lasting bubbles: Make a 50-50 mixture of glycerin and water. Add 5% detergent. A couple of tablespoons to a cup of mixture. Exact proportions are not crucial. Experiment. Make wire frames of different shapes and dip in solution. If the frames are twisted the bubbles will form minimum surface area configurations. Try putting bubbles and films together.

Further notes: The glycerin is a moisturizer that keeps the bubbles from drying out and popping. Bubbles are bigger when the humidity is high and they are protected from the wind. The best wand was two twelve inch dowels tied together this string to make a window with dowels on top and bottom. Add a handle of string on top and hold in the middle. Blow or wave. Glycerin can be purchase at ACE Hardware in the craft, soap section. I read that it can also be purchased from a pharmacy- my guess is it would cost less from the pharmacy. LEB

Explanation:
The surface tension causes the surfaces to form minimum energy surfaces. Very cool mathematics, very cool bubbles. The interference of light gives rise to colors in patterns that change over time as the films change width. See the book below for many other details.

Useful References:
"The Science of Soap Films and Soap Bubbles", Cyril Isenberg, Dover, 1992. $9.95 paper
Further comments:

Activity 1: Body Bubbles
Make bubbles with our bare hands? Yes! Some of the best bubbles are made with fingers, hands, and arms too, as long as they’re wet with bubble solution. Cooperate with another bubbleologist to find ways to combine your bubbles on the table or in the air.

Activity 2: Bubble Shapes
By blowing clusters of bubbles on the table or in their hands, students can make bubbles that aren’t round! A three-sided bubble, a four-sided bubble, a five-sided bubble, and more. By putting a wet straw into a bubble, students can blow a bubble in a bubble, or even a bubble in a bubble in a bubble. Before long, your students will be making "slinky-bubbles," "caterpillars," and many of their own clever creations.

Activity 3: Bubble Measurement
Students learn to measure bubbles in lots of different ways! They can blow a bubble next to a chart, insert a wet ruler into a bubble, even insert wet blocks into bubbles. When the bubble dome pops, they can measure the diameter, radius, or even circumference.

Activity 4: Bubble Technology
In this activity, your students experiment to discover what objects can be used to blow bubbles, which make little bubbles, and which make big bubbles.

Activity 5: Bubble Colors
We’ve all enjoyed the beautiful colors swirling around on bubbles. In this activity, students get a chance to carefully
observe those colors and patterns. They can use their observations to tell how old a bubble is and even to predict when it will pop!

**Activity 6: Bubble Windows**

At this station, students make sheets of soap film by slowly raising straws and a loop of string out of a tub of bubble solution. Surface tension within the bubble film causes the sides of the apparatus to pull together. Students experiment with the flexible bubble film by blowing on it, pulling it though the air, waving it gently, or even twisting it. Students discover how to make one window intersect another, poke things through the windows without popping them, and how the world looks through a bubble window.

**Activity 7: Bubble Walls**

Students make giant sheets of soap film by slowly raising a dowel out of a trough of bubble solution. By blowing and poking at these bubble walls, students can investigate the properties of soap films, seeing how far the films stretch and twist. Surface tension within the film causes the strings on the dowel to pull together.

**Activity 8: Bubble Foam**

Younger students enjoy stirring up bubble solution and experimenting with the resulting foam. They discover that the suds are made of tiny bubbles. Can they count or estimate how many bubbles in a handful of foam? What does foam look like through a magnifying lens? Which makes better foam, a whisk or a beater? Can bubble foam be compressed? Can they fill a bucket with foam?

**Activity 9: Bubble Skeletons**

Students dip three-dimensional "skeleton" shapes into bubble solution. Soap film clings to the skeletons, creating beautiful and interesting geometrical shapes. Students watch what
happens to the soap film when they pop and re-dip the cube shape to create a little bubble-cube in the center of the skeleton!

**Activity 10: Frozen Bubbles**

Students blow bubbles into a large, clear container with dry ice in the bottom. The bubbles will bounce and float in the container, then slowly grow in size! As the bubble gets bigger, it sinks in the container. Bubble that land on the dry ice freeze instantly. People of all ages are fascinated by what is happening to these bubbles. Wondering why is at least half the fun! Don’t spoil it by giving away "the explanation" to your students until they’ve had a chance to discuss their own ideas.

**Activity 11: Stacking Bubbles**

What shape are bubbles when they are stacked together? Let your students blow bubbles into the narrow space between two clear sheets of plexiglass. How many sides do most of these crowded bubbles have? Do the walls intersect to make a "Y" shape?

**Activity 12: Swimming Pool Bubbles**

What is it like to be inside a bubble? Fun! At this station, a student stands on a platform in the middle of a wading pool filled with soap solution. The teacher or parent volunteer raises a hula hoop to create a giant soap film cylinder around the child.

**Grade Level(s):** 4

**Subject(s):**

- Science

**Duration:** One 45 minute to an hour session

**Description:** The students blow bubbles on various surfaces, testing what pops and what doesn't. Which surfaces are friendly to bubbles? Which surfaces are unfriendly to bubbles? The students will answer these questions and relate their answers to cohesion. What is cohesion? How do you think it relates to the lesson? Cohesion is when alike
things attract to each other. They also discover if they can poke a bubble without popping it. If they can, how do they do it? The students will find that when they blow bubbles on surfaces that are wet, they will not pop. If the bubble lands on a dry surface, it most likely will pop, except wool. The students will find that they can play with bubbles when wearing wool gloves, without popping them. They will also find that when they try to poke a bubble, they must do so with something wet. For example, a wet needle will work. They will relate these findings to cohesion.

**Goals:** Student will discover what surfaces are "bubble friendly and unfriendly," meaning: which surfaces do bubbles not pop on and pop on, respectively.

NSES Standards: Science as Inquiry; Unifying concepts and processes; Physical Science: Air and cohesion.

**Objectives:** Students will:

1. find that when they blow bubbles on surfaces that are wet, they will not pop. If the bubble lands on a dry surface, it most likely will pop, except wool.
2. find that they can play with bubbles when wearing wool gloves, without popping them. They will also find that when they try to poke a bubble, they must do so with something wet. For example, a wet needle will work.
3. relate the above findings to cohesion.

**Materials:**

- Bubble solution
- wands (1 per pair)
- Venn Diagrams
- Paper clips
- straws
- wool (preferably gloves)
- various other surfaces (desk, vinyl, cotton, wax paper, etc.)

**Procedure:**

*Focus Phase*

The students will predict what will happen to bubbles blown on various surfaces. Could you possibly poke a bubble without popping it? How? Why do you think that it is or is not possible?

*Challenge Phase*

The students will pair up and have a scientific observation worksheet, which includes a Venn Diagram, to help record their observations. Pops, sometimes pops/sometimes doesn't, and doesn't pop will be the choices on the
Venn Diagram.
They will go to different stations around the room and blow bubbles.
They will be asked: Which surfaces are friendly to bubbles?
The students will also be asked, "How do you think you could poke a bubble without popping it?"

*Concept Introduction Phase*

The students will be asked what they found out in a whole class discussion. Did they predict correctly what would happen, or did the activity change their minds? Why do they think that the bubbles did not pop on wet surfaces?

*Concept Application*

Think about bubbles in a bathtub, kitchen sink, or when you blow them outside? What type of surfaces do they pop on? Why do you think they do not "pop" in the bathtub or the sink? What is cohesion and how does it relate to the bubbles? Using the information you learned, answer the questions.

*Assessment:*

The students will be assessed informally on their participation.
They will be formally assessed by turning in their prediction sheets and their Venn diagram with sentences on the back defining and explaining what they think cohesion is after the discussion to be sure that they understood the lesson objective.