

Investigations Into the Science of Bubbleology



*A Playground
Exploration of
Bubbles*

Bubbleology is a summer investigative program offered at the Playground. Blowing soap bubbles is a captivating, colorful, and fun activity for kids of all ages. Watching a soapy puddle turn into a beautiful, fragile, multi-colored sphere is always a fascinating experience. Not only are bubbles universally fascinating, but also they can be used to teach many science skills and concepts. Some of the concepts include light and color, aerodynamics, chemical composition, surface tension, and technology.

Bubbleology develops the following skills: making observations, experimenting, making inferences, and drawing conclusions. Investigative questions include: Can you blow a bubble with a pair of scissors? Which brand of dishwashing liquid will make the biggest bubbles? How can you best keep a bubble aloft? Through a variety of activities, students will experiment to discover the answers to these and many more questions.

As a result of this investigation of bubbles Playgrounders will discover:

- Properties of bubbles
- Bubbles can be described on the basis of their properties of color, shape, and what conditions they like
- When measuring bubble solutions the best characteristics to judge a bubble on are measurable, like bubble size and how long the bubble lasts
- Bubbles like wet surfaces; therefore bubbles will last longer in a wet environment;
- The faster the air moves over the bubble, the lower the pressure over the bubble and the bubble stays aloft. Generally, to keep a bubble aloft the pressure must either decrease above the bubble or increase below it;
- Smaller bubbles have greater internal pressure than larger bubbles.

Resources

4 brands of liquid dishwashing soap	straws
bubble wands	soap solution dishes
measuring cups	aluminum pie pans
fan	kitchen implements
glycerine	eye droppers
black construction paper	maynoaise jars
clay	

Lesson Plan (5E Format: Engage, Explore, Explain, Elaborate, Evaluate)

Engage

Playgrounders learn via coaching how blow bubbles. For those who are challenged a fan can be made available for bubble making. Playgrounders should be encouraged to blow

slow and fast and observe results. Playgrounders should try waving the bubble wands to make bubbles. Experimentation should include short quick movements as compared to long sweeping movements. The phase of the lesson can be prolonged based on interest and serve as day one of the lesson. Playgrounders should be encouraged to spread out by breaking up into small groups with a counselor to assist.

Explore

- Once Playgrounders have become acquainted with making bubbles their attention should be drawn to identifying properties (size, shape, colors, fluid activity on the surface of the bubble) of bubbles and encouraged to formulate questions about bubbles.
- Next, Playgrounders experiment with different “tools” to make bubbles such as: straws, small wire frames of different shapes (round, square, triangle), spatulas with slots, tubes, lids, potato masher, other kitchen implements. Playgrounders should compare/contrast bubble tools with differently shaped holes and the shape of the bubble produced by a given tool. They will observe to learn that a free-floating bubble will always form a sphere regardless of the shape of the hole from which it was blown. Encourage children to bring in their own tools and try this activity the next day.
- Next, Playgrounders investigate the color sequence which leads to the bursting of a bubble by comparing flat bubble films and bubble hemispheres. Playgrounders should be led to discover that they can predict when a soap film will pop. Using a small or large bubble frame Playgrounders dip the frame in the soap solution and after obtaining a soap film observing the colors and the color changes.

Playgrounders should observe the soap film colors and determine where the soap film is thinning most rapidly when the bubble frame is in a vertical position. Repeat as needed. Use a straw to blow a large hemisphere on a dark surface. Note the color sequence in each hemisphere until it pops. Before it pops the color sequence changes in this order: green, blue, magenta, yellow, white, white with spots, black - POP!

- Next, Playgrounders discover the effect different surfaces have on bubbles. Playgrounders will classify surfaces as friendly (doesn't pop) and unfriendly (pops). After experimenting with different surfaces, Playgrounders will determine the relationship between bubbles and wet surfaces.
- Based on previous observations and experiments, Playgrounders will should be aware that there are many ways to test a bubble. In this experiment, Playgrounders will discuss bubble recipe ideas in making the best bubble solution (bubble size and how long the bubbles last). Variables beyond the amount of dishwashing liquid should be evoked, such as: different brands of soap and water temperature.

Counselors in a small group format conduct demonstration experiments for their group. These experiments include testing the aforementioned variables: water temperature, soap brands, and various solutions. Playgrounders should be allowed to join in as convenience permits. At the conclusion of the series of experiments, those interested should be permitted to play with making bubbles using the “best solution”.

- Next, Playgrounders experiment, with the help of their counselor in a small group, on the effect of glycerine added to a soap solution. First, blow several bubbles to establish a base line for size and duration. Then, add 3 drops of glycerine, blow several bubbles and observe any changes. Repeat this procedure for 10, 15, and 20 drops of glycerine.
- The cumulative experiment is: Can a bubble be kept *alive* in a jar? Ask Playgrounders if they think a bubble can be kept, or saved in a jar, without popping. SECRET NOTE: Eiffel Plaster kept a 4 inch bubble alive for 340 days in a closed jar. First, blow a bubble, then capture it on the bubble wand. Place the handle of the wand in a lump of clay resting on a dry aluminum pie pan, allow Playgrounders to observe the bubble until it pops. Counselors should time how long it takes to pop in open air. Repeat the experiment several times to determine an average time.

Next, wipe away any moisture on the clay or pie pan. Repeat the above procedure, but this time quickly cover the bubble with a dry jar. Observe, time, repeat for an average result.

Finally, repeat the above procedure, but this time quickly cover the bubble with a wet jar (inside). Observe, time, repeat for an average result.

Elaborate

Review the lessons learned from the Playground’s investigation of bubbles. Discuss properties of bubbles, observations, best bubble making solutions, and the best environment for bubble survival.

Make a bubble painting. Mix different colors tempera paint into bubble solutions. Using a straw, blow bubbles so that the pop on white construction paper. Repeat with single, or different colors to create a collage.

Evaluate

Evaluation is measured informally throughout the lesson. Playgrounder assessment is in accordance with the 7 learning objectives listed above and their level of cooperation using the below assessment tool. Counselors should provide comment to the Playground Director for improvement of this activity.

Cooperative Learning Self - Evaluation

1. Did I take turns and do my job?
2. Did I get along with others?
3. Did I follow directions?
4. Did I listen to others?
5. Did I clean up?